

RADIOLOGY

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TO CLINICAL RADIOLOGY AND
ALLIED SCIENCES



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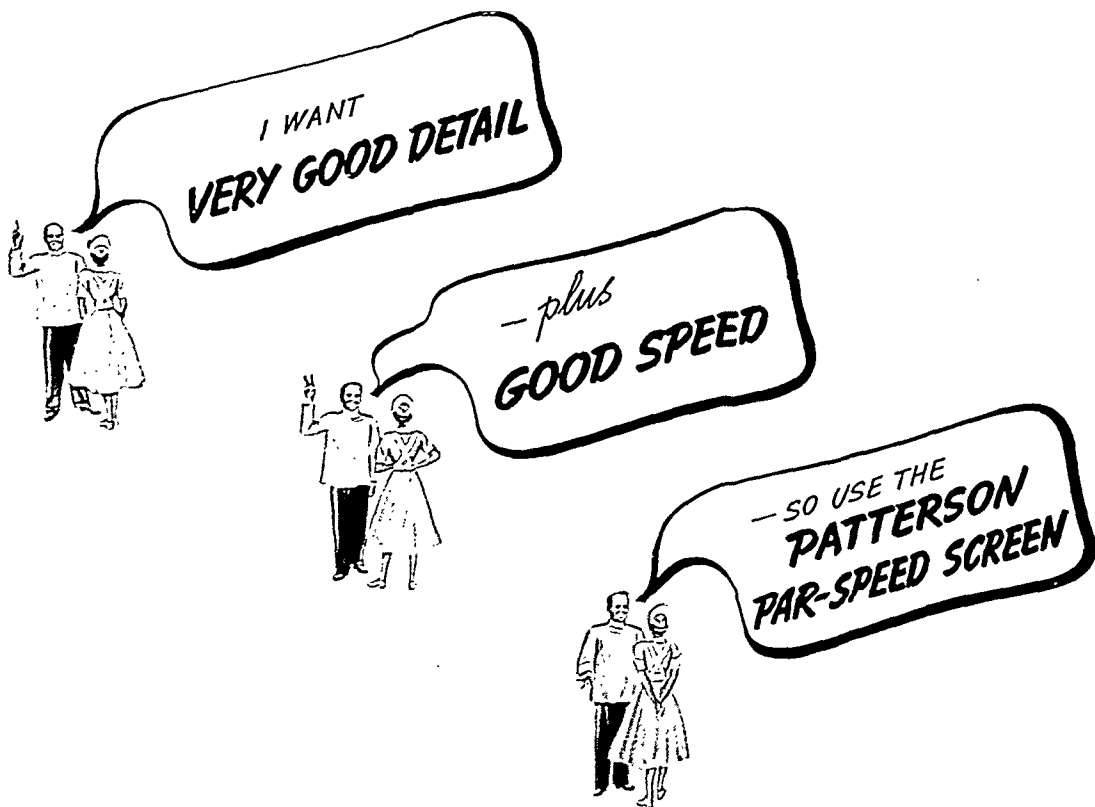
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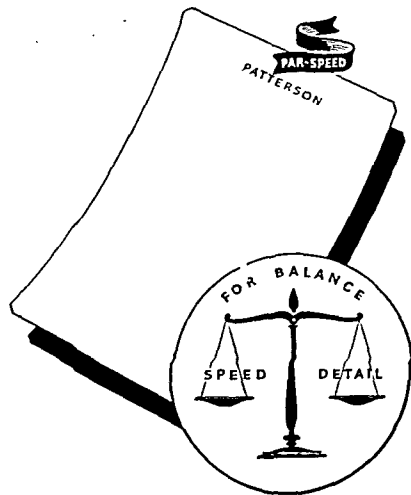
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RADIOLOGY

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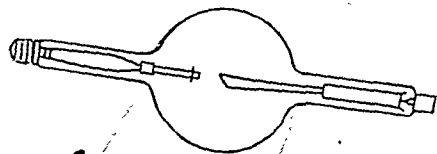
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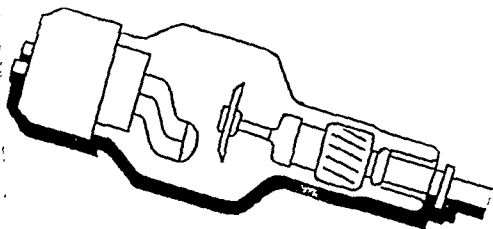


● Recent observance of the 25th anniversary of Coolidge's hot-cathode tube was an occasion for many interesting reminiscences among radiologists whose experience dates back to the gas-tube era.

Overheard in these "remember way back" sessions are frequent references to the revolutionary changes in x-ray technology following introduction of the Coolidge tube — how "hunch" methods in radiography were soon superseded by standardized technics which could be relied upon for a faithful reproduction of results.

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No less interesting are the reminiscings of men who pioneered in roentgen therapy — how they acclaimed Coolidge's hot-cathode tube because it gave them positive control of both quality and quantity of x-rays, and assured accurate measurements of dosage; also their chronological review of Coolidge's further contributions to the roentgen therapist's armamentarium, such as the first deep-therapy (200,000-volt) tube, the first 400,000-volt permanently evacuated tube, the first 200,000- and 400,000-volt self-rectifying tubes for oil-immersion, the first multi-section 800,000-volt tube — up to the latest million-volt Coolidge tube.

Thus the records of a quarter-century of Coolidge tube developments are closely woven into the story of notable achievements and progress in the fields of x-ray diagnosis and x-ray therapy. And gratifying indeed is the fact that Dr. Coolidge continues to direct research which anticipates tomorrow's increased requirements in radiology.

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NO. 2

THE APPLICATION OF SIALOGRAPHY IN NON-NEOPLASTIC DISEASES OF THE PAROTID GLAND¹

By JOHN V. BLADY, M.D., and ALFRED F. HOCKER, M.D., *New York City*

From the Head and Neck Department, Service of Hayes E. Martin, M.D., Memorial Hospital

SIALOGRAPHY, the roentgen visualization of the parotid and submaxillary salivary glands after the injection of lipiodol into their respective ducts, has made possible a definite advance in the study of diseases affecting these organs. Prior to the discovery of this method of investigation, the diagnostic measures consisted of manual palpation, exploration of the duct by probe, surgical exploration of the duct and gland, and x-ray examination for opacities. Sialography now enables one to visualize the entire duct system in a manner comparable to a lipiodol study of the bronchial tree.

Many of the diseases arising in the salivary glands produce characteristic changes which are readily demonstrable on the sialogram. The filling defect produced by a mixed tumor is seen as an orderly displacement or distortion of the duct system, while carcinoma may produce irregular filling defects in the duct and gland substance, localized diffusion or puddling of lipiodol, and incomplete filling of the duct system. We have previously described the various changes associated with different neoplastic conditions (7).

In this presentation we are concerned

with a study of the changes observed roentgenographically in non-neoplastic diseases of the parotid gland. Thirty-eight such cases have been studied. In each the clinical, the histologic (whenever available), and the roentgenographic findings have been correlated.

TABLE I.—NON-NEOPLASTIC DISEASES OF THE PAROTID STUDIED BY SIALOGRAPHY

Acute and chronic parotitis.....	15
Post-operative parotitis.....	1
Extraparotid infections, osteomyelitis and cellulitis.....	4
Salivary fistulae.....	4
Calculus.....	2
Stricture of Steno's duct.....	7
Mikulicz' disease.....	1
Xerostomia.....	3
Repair of duct.....	1
Total.....	38

TECHNIC

In the present report we shall present only a brief résumé of the technic as a complete detailed description is given elsewhere (7).

The *paraphernalia* needed for the injection of lipiodol are a 2 c.c. tuberculin syringe and a 20-gauge three-inch needle, the tip of which has been made blunt. A lachrymal dilator or tapered probe and an ordinary blunt fine wire probe complete the necessary apparatus. Lipiodol (40 per cent iodine) is used for the injections.

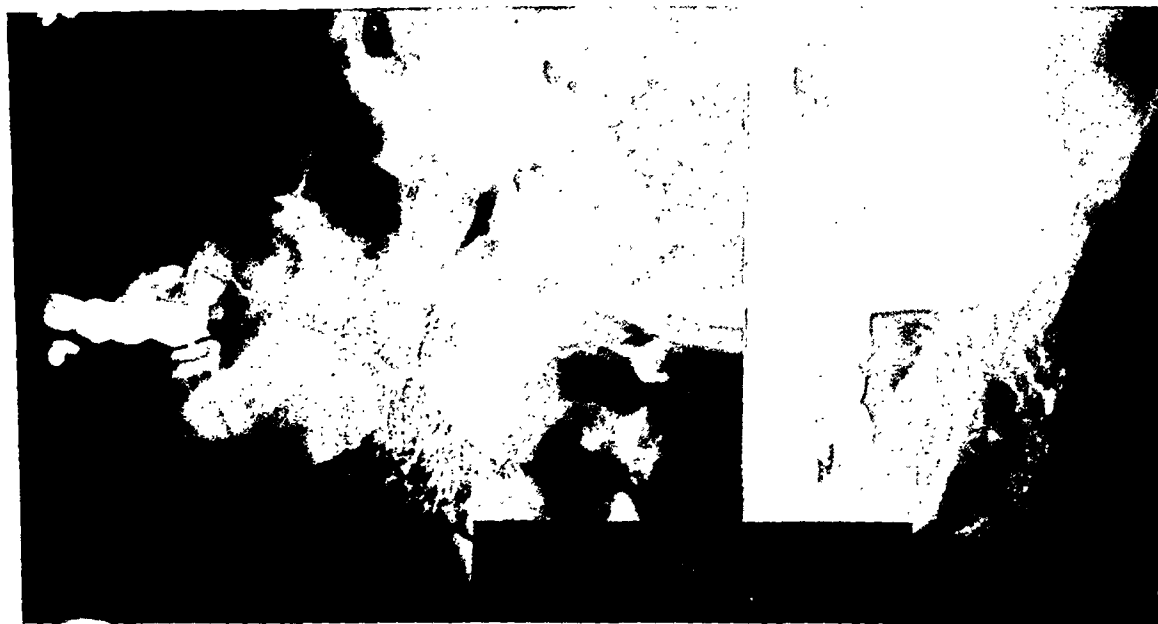
¹ Read in part at the Fifth International Congress of Radiology, at Chicago, Sept. 13-17, 1937.

It is best to immerse the oil in hot water immediately before using, thereby increasing its fluidity.

The injection is most satisfactorily made with the patient in a sitting position.

ejected or expressed. When the above measures fail, gum chewing or sucking a lemon or some similar substance may stimulate a flow of saliva.

After the duct is located, dilatation may



A

B

Fig. 1-A. Normal sialogram, lateral view. The lipiodol is dispersed throughout the finer ramifications of the duct system, rendering a roentgen visualization of the entire duct system.

Fig. 1-B. Same patient; anteroposterior projection.

However, should this position not be feasible and if the duct can be easily located and readily probed, the injection can be performed with the patient lying supine on the x-ray table. As a source of good light we use an electrically illuminated head mirror.

The mucous membranes surrounding the orifice may be anesthetized by a topical application of a 10 per cent solution of cocaine.

The location of the duct orifice is in the papilla of the buccal mucous membrane adjacent to the second upper molar tooth. If the orifice is not visible, gentle massage over the gland and duct will express saliva and thereby disclose its location. Drying the papilla with a cotton applicator or spraying it with air will aid in identifying the point from which the drop of saliva is

be necessary and can be readily accomplished with the lacrimal dilator or tapered probe.

The injection should be carried out slowly and gently, since in adequate amounts the procedure invariably produces some discomfort and pain due to the distention of the ducts. The minimum amount of lipiodol should not be less than 1.00 c.c. and the maximum should not exceed 1.75 c.c. To prevent the escape of the lipiodol after the needle is withdrawn, the patient is requested to compress the orifice of the duct by squeezing the cheek between the thumb and forefinger with gauze.

The roentgenograms may be made on either an upright or a horizontal Potter-Bucky table. Stereoscopic lateral and either single or stereoscopic postero-anterior projections should always be ob-

tained with the head well hyperextended in the lateral view to give better visualization of the retromandibular region.

1. INFLAMMATORY DISEASES

(A) *In acute suppurative parotitis* the roentgen appearance is dependent on the degree of changes resulting from the infection. The earliest changes in the major duct system usually consist of a distention or a beading, or both, caused by the presence of thick flaky debris and pus within the major ducts. Early changes in the gland itself consist of small alveolar dilatations, which, when filled with lipiodol, give the appearance of droplets. As an actual breakdown of the glandular structure occurs, cavities form and later these may coalesce to form large cystic dilatations. Recently Feuz (15) has described the syndrome "retro-parotid of Villaret" in which an attack of erysipelas was followed by an acute suppurative parotitis; this later perforated into the external auditory canal. The sialogram in this case showed communicating cystic dilatations throughout the gland parenchyma.

Acute parotitis usually develops as an ascending infection by way of the ducts. The patient complains of swelling in the parotid region, has fever, and is usually in a generally depressed condition. Pus exudes or can be milked from the duct and the duct orifice is swollen and red. The offending organism is usually some type of staphylococci (8).

These infections are generally associated with surgical operations, generalized infections, oral or dental sepsis, and starvation so often associated with acute abdominal conditions.

(B) *Chronic recurrent parotitis* is a definite clinical entity in which the roentgen findings are sometimes similar to those observed in the acute cases. Steno's duct is generally dilated and, being filled with non-opaque inspissated material around which lipiodol collects, it presents a beaded appearance as is seen in Figure 2-B. The affected portions of the gland are visualized as small spherical collections or droplets of

lipiodol simulating the picture seen in bronchiectasis. Frequently the entire gland presents this roentgen appearance. In five of our cases the condition was bilateral. Londe and Pelz (29), reviewing 18 cases from the literature up to 1933, reported that in five the condition was bilateral.

Chronic recurrent parotitis is clinically characterized by a recurrent swelling of the parotid gland associated with a discharge of thick pus or cloudy, flaky saliva from the duct. As the secretions become inspissated, flakes of material or even casts of the duct can sometimes be expressed from the duct orifice. The swelling of the gland usually lasts from three to ten days and in some cases for even longer periods. The swelling may recur at intervals of weeks or months.

The etiology is not always known. Sometimes these swellings occur spontaneously without any apparent reason. Roentgenographically it has been shown that the identical changes are associated with duct calculi, intermittent duct obstruction by tumors and occasionally by stricture. According to Payne (34), these changes are observed with mild degrees of infection of the parotid duct.

Londe and Pelz state that normally various organisms are found in Steno's duct; on the other hand, the smaller ducts and the gland tissue are sterile. Claisse and Dupree (quoted by Kroiss) could not produce inflammation of the salivary gland in dogs by the injection of bacteria, irritants, or foreign bodies into the ducts. Furthermore, experimental obstruction of the duct produces an atrophy of glandular tissue rather than inflammation.

Quite frequently the swelling of the gland occurs after eating. It is possible, therefore, that during mastication minute particles of food, mucoid debris or, in the presence of oral infections, small accumulations of pus are forced into the duct orifice, thereby producing an obstruction. This results in a retention of the parotid secretions and the gland gradually becomes diffusely enlarged. It seems probable, there-

fore, that the bacteria entrapped in such an obstructed duct are in a medium which promotes their multiplication, while in the normal unobstructed duct they are continually washed out of the duct system.

(C) In *epidemic parotitis* (mumps), Hobbs, Sneierson, and Faust (22) have demonstrated the typical inflammatory picture on the sialograms.

(D) *Miliary abscesses* following strepto-



Fig. 2-A (above). Acute parotitis. The sialogram demonstrates typical droplet formation or cystic dilatations characteristic of this condition.

Fig. 2-B (below). Chronic recurrent parotitis. Steno's duct is greatly dilated and is filled with non-opaque inspissated material around which lipiodol collects and produces the above beaded appearance. The dilated gland alveoli are represented by the small spherical collections or droplets of lipiodol.

coccus and typhoid septicemias, according to Rocchi (40), give the identical roentgen changes as observed in other inflammatory conditions.

2. OBSTRUCTIONS

Obstructions of Steno's duct are produced by duct calculi, stricture and extrinsic pressure on the duct by tumors or other extra-parotid affections. Each of these conditions is responsible for characteristic changes demonstrable by sialography.

(A) *Calculi* in the parotid gland, as in other organs, are not always radiopaque. If, however, their presence is suspected, a roentgenographic examination of the affected parotid region should be made. Unusually small stones may not be visualized on the roentgenograms or they may be superimposed on dense structures and thus fail to be recognized. In some cases calculi can be demonstrated by utilizing a soft tissue technic in the anteroposterior projection. If located in the duct or accessory gland, a very excellent demonstration can be obtained on an oral or dental film. Sialography does not aid in the demonstration of a calculus in the gland; on the other hand, if the calculus is in Steno's duct a filling defect or point of obstruction produced by the calculus is demonstrated by the lipiodol injection. The duct beyond the region of the obstruction is usually greatly dilated. The inflammatory changes associated with the presence of calculi are similar to the roentgen findings observed in other inflammatory conditions. Occasionally these changes are localized to a small portion of the gland. In the case illustrated in Figures 3-A and 3-B, both glands are extensively involved.

New and Harper (32), analyzing 70 cases of salivary gland calculi, reported an incidence of 92.9 per cent for the submaxillary gland, 4.3 per cent for the parotid gland, and 2.8 per cent for the sublingual gland. Wakeley (44), on the other hand, gave the following percentage of incidence: submaxillary 63.2 per cent, parotid 20.6 per cent, and sublingual 16.2 per cent. Wakeley

states that multiple parotid calculi are more common than single, while in each of the three cases reported by New and Harper a single calculus was found. In Noehren's (33) case 14 stones were removed from the parotid duct at one operation. In the two cases of this series multiple stones were found.

The size of salivary calculi may vary from that of a pin-point to one reported by Garretson (16) as measuring one and one-eighth inch in length and two inches in circumference. Orth described a stone weighing 70 grams. The calculi associated with the parotid gland and duct, however, are usually quite small, while those of larger size are usually found in the submaxillary and sublingual glands and ducts.

(B) *A stricture or a stenosis of Steno's duct* is generally well demonstrated by means of a lipiodol injection. If a complete stenosis exists, only the patent portion of the duct is visualized. A partial stricture is always clearly demonstrated as a marked narrowing or constriction. The portion of the duct beyond the point of obstruction is dilated. In the case illustrated by Figure 4, three such constricting regions were present; two of these are clearly demonstrated (Fig. 4-B) while the third was located near the duct orifice and was discovered when dilatation of the duct was attempted.

In two of the cases in which the duct had been incised for removal of calculi, the duct was found patent for about one and two centimeters, respectively. At these points the stenosis was complete and neither probing nor attempted injection was successful. In each case the parotid gland and also the accessory lobule were definitely palpable as an enlarged, firm, smoothly outlined mass. In these cases, the gland eventually undergoes complete atrophy due to pressure by the retained secretions. As a rule, inflammatory changes are not observed with this type of obstruction.

(C) *Pressure on duct by extra-parotid disease* may produce partial or intermittent obstruction. On the sialogram the point of

compression or displacement of the duct is readily demonstrated and in addition to the proximal dilatation of the duct system, localized inflammatory changes may be observed. This roentgen picture may be seen

with either infections or tumors located in close proximity to the gland or duct.

We have observed one case in which a small mixed tumor located in the accessory gland compressed the duct in such a way as



Fig. 3-A (above). Parotid gland calculi. Lateral roentgenogram of the right parotid region showing gland calculi as small rounded opacities in the retromandibular region.

Fig. 3-B (below). Sialogram (anteroposterior projection) reveals typical inflammatory changes, frequently associated with calculi, involving both parotid glands. The left gland exhibits diffuse cystic dilatations throughout the parenchyma. The right side had been injected a day previously and lipiodol is still present in the "bronchiectatic" or cystic dilatations.



Fig. 4-A (*above*). Stricture of Steno's duct. Lateral view demonstrates the marked dilatation of the entire duct system due to the presence of three strictures. Two are shown in Figure 4-B and the third, located near the duct orifice, was discovered when dilatation of the duct was attempted.

Fig. 4-B (*below*). High vertex projection of the same patient as shown in Figure 4-A. Two of the strictures are clearly visualized; one is located at the anterior border of the masseter muscle and the other about one centimeter distal to it. The duct system within the gland is greatly dilated but otherwise appears normal.

to produce an obstruction similar to that observed with stricture of the duct.

Infections, arising either in the soft tis-

addition to the displacement of the duct by the swelling, the sialograms demonstrate a normal duct system (Figs. 8-A and 8-B).

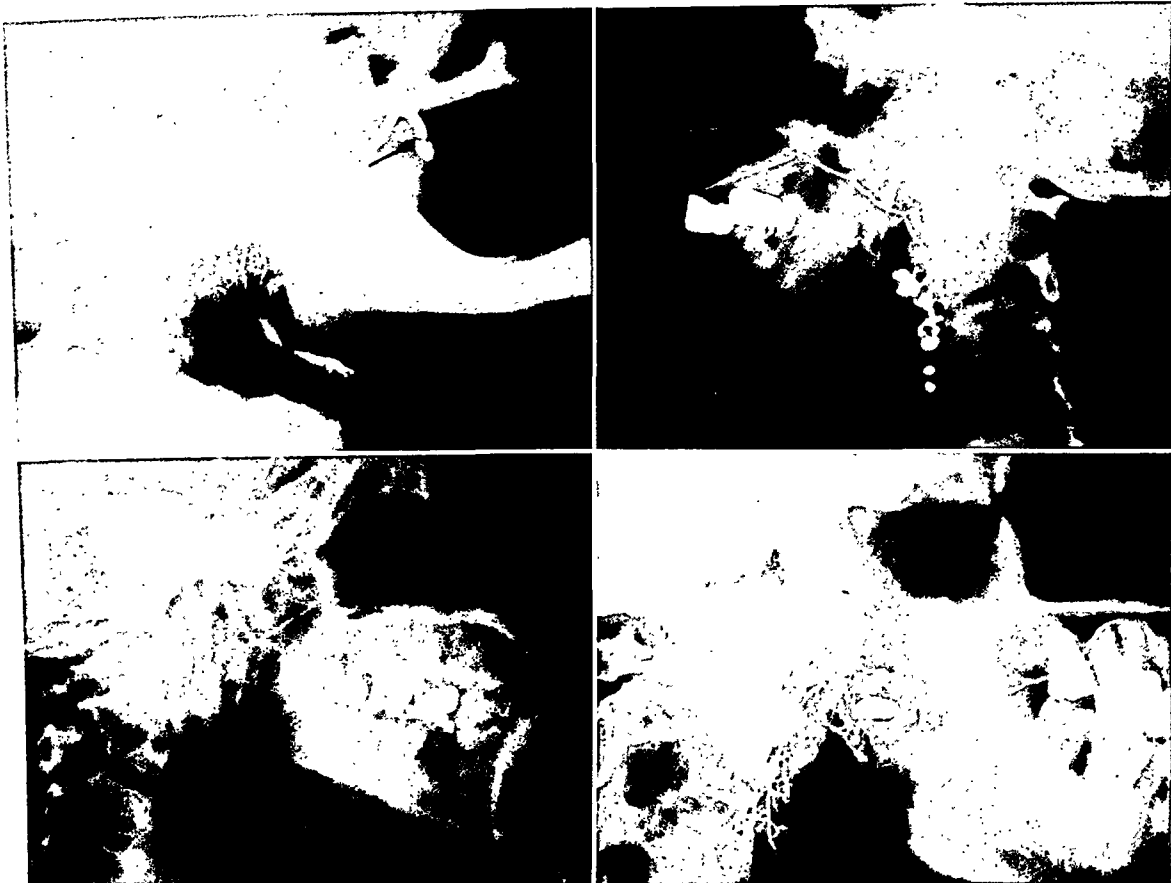


Fig. 5 (*upper left*). Structure of Steno's duct. The major duct system is dilated and a definite constriction near the duct orifice in the buccal portion of the duct is visualized.

Fig. 6-A (*upper right*). Parotid gland fistula. Lateral roentgenogram demonstrates a fistulous tract persisting eight days after an incisional biopsy on a mixed salivary tumor.

Fig. 6-B (*lower right*). This fistulous tract is the result of a surgical biopsy on an adenocarcinoma of the parotid gland. Aspiration biopsy causes similar traumatic changes. Fistulae are also associated with infections and injuries. Whenever a biopsy procedure and a sialographic study are contemplated in the same individual, it is essential to have the lipiodol injection done first. The irregular puddling due to the trauma may be superimposed over ducts, obscuring duct detail, and thus may lead to an erroneous roentgen diagnosis.

Fig. 7 (*lower left*). Xerostomia. This condition is characterized by a diminution or absence of salivary secretions, and dry parchment-like oral mucous membranes. The sialograms are characteristic. The entire duct system, and especially Steno's duct, is of a much smaller caliber than normally seen (Fig. 1). In addition, the injection of a minimal amount of lipiodol (1 c.c.) results in diffusion of the opaque medium into the gland parenchyma.

suces of the cheek or extending into the soft tissue from a primary focus in the teeth or the mandible, result in swelling which, in turn, may produce certain degrees of obstruction by displacing and compressing a portion of the duct. In these cases, in

3. FISTULÆ

Parotid fistulae are readily demonstrated by sialography. The duct system and the point of origin as well as the ramifications of the sinus tract are clearly revealed by the injected lipiodol. In this series four

salivary fistulae were studied, one following an incision of an abscess of the parotid gland and three following biopsy proce-

In the two cases studied, the mucous membranes were extremely dry, parchment-like in appearance, and the tongue

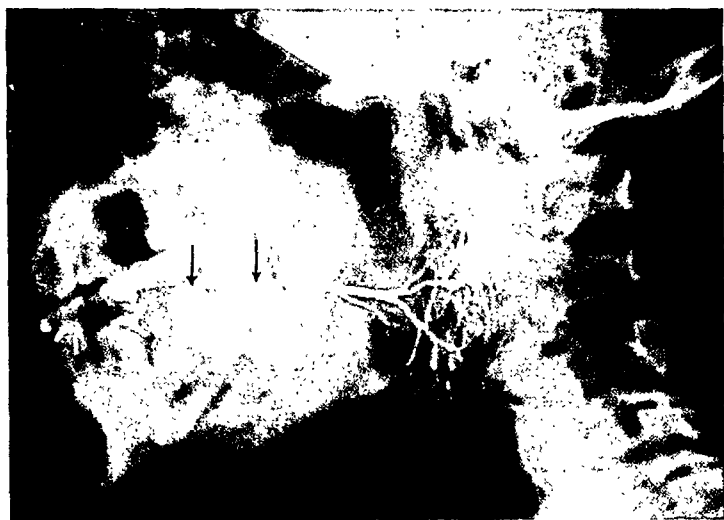


Fig. 8-A.

Fig. 8-A. Extra-parotid infection. Seven days before admission patient had two molar teeth extracted from left maxilla. Five days later swelling of cheek developed which gradually spread and involved the entire left side of face and cheek. The possibility of post-operative parotitis was considered and for this reason a lipiodol injection was performed. The lateral roentgenogram demonstrates a normal distal duct system. The anterior half of the duct, however, is thinned out, compressed and displaced laterally by the soft tissue swelling in the cheek. Incidentally the cause, an unsuspected osteomyelitis of the mandible arising in an apical tooth abscess, is demonstrated.

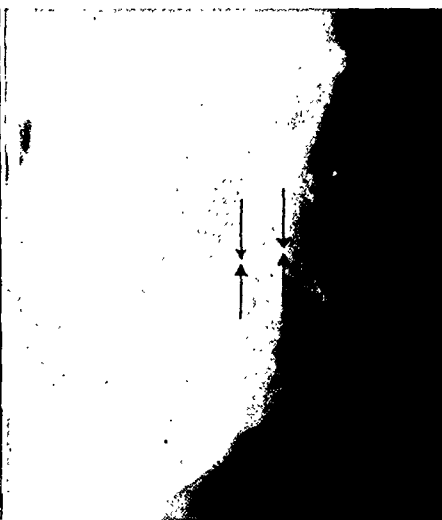


Fig. 8-B.

Fig. 8-B. The lateral roentgenogram shows the marked thinning out and lateral displacement of the anterior half of the duct.

dures. In the abscess case the fistula persisted for approximately six months and then spontaneously healed.

4. XEROSTOMIA

Xerostomia or aptyalism is due to a diminution of the salivary secretions. It may be apparent only during eating or may be so marked that the oral mucous membranes, tongue, and lips are completely dry. The major salivary glands may exhibit no noticeable abnormality or may be palpably enlarged, in which case thick mucus may be expressed from the ducts.

The sialograms in this condition are rather characteristic. The entire duct system, and especially Steno's duct, is of a much smaller caliber than is normally seen (Fig. 7). The injection of a minimal amount of lipiodol (one c.c.) results in diffusion of the opaque media into the gland parenchyma.

was dry and fissured. The duct orifices were of pin-point size and were identified only after prolonged stimulation of salivary secretions by chewing gum and sucking lemons.

5. MIKULICZ' DISEASE

The typical Mikulicz syndrome has been observed in one individual on whom parotid sialograms were performed. The duct system was found to be of normal size; however, a low threshold tolerance for lipiodol was observed as 1.25 c.c. readily diffused throughout the gland substance.

6. EXTRA-PAROTID DISEASE

In the consideration of treatment it is of great importance to determine whether a lesion arises in the gland itself or whether it is of extra-parotid origin. The extrinsic lesion, either infection or neoplasm, may be in any location adjacent to the gland,

such as the preauricular, mastoid, retro-mandibular, or submandibular regions.

Infections arising in the soft tissues of the cheek, maxilla, or mandible may extend and involve the parotid area. In the two cases of this series, the infections involved the entire side of the face and cheek. In one case the onset occurred one week after extraction of teeth, while in the other it had been present for a longer period. In both patients there was sufficient evidence to suggest the possibility of a post-operative parotitis. The sialograms demonstrated a normal duct system, thereby definitely establishing an extra-parotid origin of the infection (Figs. 8-A and 8-B).

As has been previously pointed out, the defect of a mixed tumor or the destructive changes of carcinoma primary in the gland are demonstrated by sialography. On the other hand, extrinsic tumors such as branchiogenic cysts, lymphadenitis, tuberculous lymphadenitis, lipomas, and metastatic cancer in the neck nodes may produce a slight peripheral displacement or distortion of the terminal ramifications of the ducts, thus differentiating this type of defect from that observed with mixed tumors.

7. TRAUMA

Injury to the structures in the neighborhood of the parotid gland or duct may result in a laceration or complete severance of Steno's duct or some of the secondary ducts. A sialographic study in these cases will reveal the extent and the location of the injury to either the duct or gland. Furthermore, the procedure may be used post-operatively to demonstrate the patency of the duct or any post-operative sequelæ such as complete or partial stenosis or chronic inflammatory changes. Recently we performed a sialographic study on a patient in whom a complete severance of the duct had been successfully repaired. The sialograms revealed an entirely normal duct system.

SUMMARY

A sialographic study of 38 cases of various non-neoplastic conditions affecting the

parotid gland is presented. The study includes a brief consideration of clinical findings and their correlation to the roentgen findings in the following conditions: (1) inflammatory disease, (2) obstructions, (3) fistulæ, (4) xerostomia, (5) Mikulicz' disease, (6) extra-parotid diseases, and (7) trauma.

The technic of injection is briefly described and the various conditions discussed are illustrated.

BIBLIOGRAPHY

- (1) ANTHONY, D. H.: Affections of Salivary Glands and Their Ducts. *Jour. Tenn. Med. Assn.*, 24, 175-192, May, 1931.
- (2) ARCELIN: Radiographie d'un Calcul Salivair de la Glande Sublinguale. *Lyon Med.*, 118, 769, 1912.
- (3) Idem: Quoted by A. Berraud, who gives the following reference: *Revue pratique d'electrologie et de radiologie medicales*, 3, May, 1913.
- (4) BARSKY, A. J., and SILBERMAN, H.: Roentgen Visualization of the Parotid Gland by Means of Lipiodol Injection. *Ann. Surg.*, 95, 46-51, January, 1932.
- (5) BARSONY, T.: Idiopathic Dilatation of Steno's Duct. *Klin. Wchnschr.*, 4, 2500, 2501, Dec. 24, 1925.
- (6) BERRAUD, A.: Roentgenography of the Salivary Ducts. *Revue de Laryng.*, 52, 453-457, July, 1931.
- (7) BLADY, J. V., and HOCKER, ALFRED F.: Sialography: Its Technic and Application in the Roentgen Study of Neoplasms of the Parotid Gland. *Surg., Gynec. and Obst.*, 67, 777-787, December, 1938.
- (8) BLAIR, V. P., and PADGETT, E. C.: Pyogenic Infection of Parotid Glands and Ducts. *Arch. Surg.*, 7, 1-36, July, 1923.
- (9) CARLSTEN, D. B.: Lipiodolinjektion in dem Ausführungsgang der Speicheldrüsen. *Acta Radiol., Stockholm*, 6, 221-223, 1926.
- (10) CECIL, R. L.: *Textbook of Medicine*, 1930 edit. W. B. Saunders Co., Philadelphia.
- (11) CSILLAG, A., and CZUNFT, V.: Roentgen Examination of Salivary Glands with Contrast Substance. *Acta Otolaryng.*, 21, 329-342, 1934.
- (12) CSILLAG, A.: Practical Value of Sialoadenography in Diagnosis of Intermittent Swelling of the Salivary Gland. *Acta Otolaryng.*, 23, 481-498, 1936.
- (13) FEUZ, J.: Über die Speicheldrüsen. *Arch. f. Ohren-, Nasen- u. Kehlkopfh.*, 132, 308-325, 1932.
- (14) Idem: A propos des glandes salivaires. *Schweiz. med. Wchnschr.*, 62, 666-671, 1932.
- (15) Idem: La Sialographie-Sa technique, ses indications, son utilité. *Rev. de laryng.*, 56, 1037-1116, November, 1935; 57, 66-89, January, 1936.
- (16) GARRETSON: Quoted by Harrison (19).
- (17) GRASSO, R.: Diagnostic Value of Sialography. *Gior. veneto di sc. med.*, 8, 351-358, April, 1934.
- (18) HARE, H. F.: Oralography or Lipiodol Injection of Salivary Ducts. *Surg. Clin. No. Am.*, 15, 1567-1573, December, 1935.
- (19) HARRISON, G. R.: Calculi of the Salivary Glands and Ducts. *Surg., Gynec. and Obst.*, 43, 431-435, 1926.
- (20) HENKE, F., and LUBARSCH, O.: *Handbuch der speziellen pathologischen Anatomie und Histologie*, 2, 61-73. Julius Springer, Berlin, 1929.
- (21) HICKEY, P. M.: Demonstration of Salivary Calculi. *Am. Jour. Roentgenol.*, 2, 776, 1915.
- (22) HOBBS, W. H., SNEIERSON, H., and FAUST, C. L.: Acute and Chronic Infections of the Parotid Gland:

Treatment by Dilatation of Stenson's Duct. *Surg., Gynec. and Obst.*, 54, 555-563, March, 1932.

(23) HOOVER, W. B.: Obstruction of the Salivary Ducts. *Surg. Clin. No. Am.*, 11, 303-313, April, 1931.

(24) IACOBOVICI, POPLITZA, and ALBU: La Sialographie. *Presse méd.*, 34, 1188, 1926.

(25) IACOBOVICI, I., and JIANU, S.: La radiographie des voies salivaires après injection de substance opaque (sialographie). *Jour. de radiol. et d'électrol.*, 17, 507-510, September, 1933.

(26) KEITH, H. M.: Injection of Parotid Gland with Iodized Oil. *Jour. Am. Med. Assn.*, 90, 1270, 1271, April 21, 1928.

(27) KROISS: Quoted by Londe and Pelz (29).

(28) LANGE, K.: Die Darstellung der Parotisgänge mittels Lipiodol bei Speichelfisteln. *Chirurg*, 4, 877, 878, Nov. 15, 1932.

(29) LONDE, S., and PELZ, M. D.: Chronic Sialodochoparotitis with Recurrent Subacute Exacerbations. *Jour. Pediat.*, 2, 594-602, May, 1933.

(30) MAGNONI, A.: The Value of Sialography in Parotid Affections. *Quaderni Radiol.*, 2, 140-149, 1937.

(31) MAINCOT, G.: Radiographies de calculs salivaires. *Bull. et Mem. Soc. de Radiol. méd. de Paris*, 2, 192, 193, June, 1910.

(32) NEW, G. B., and HARPER, F. R.: Chronic Inflammation of the Salivary Glands with or without Calculi. *Surg., Gynec. and Obst.*, 53, 456-460, October, 1931.

(33) NOEHREN, A. H.: Multiple Calculi in Stenson's Duct. *Jour. Am. Med. Assn.*, 80, 25, Jan. 6, 1923.

(34) PAYNE, R. T.: Sialography: Technic and Application. *British Jour. Surg.*, 19, 142-148, July, 1931.

(35) Idem: Sialography. *British Jour. Radiol.*, 54, 492-497, June, 1932.

(36) POIRIER, P., and CHARPY, A.: *Traité d'Anatomie Humaine*, 1904 ed., 1914 ed., p. 89. Masson, Paris.

(37) PYRAH, L. N., and ALLISON, P. R.: Some Sialograms. *British Med. Jour.*, 2, 1028-1030, Dec. 5, 1931.

(38) PYRAH, L. N.: Chronic Parotitis: Report of Four Cases with Sialograms. *British Jour. Surg.*, 20, 508-515, January, 1933.

(39) ROBERG, B. T.: Sialolithiasis. *Ann. Surg.*, 39, 669-682, 1904.

(40) ROCCHI, F.: Normal and Pathologic Skiagraphy. *Riv. di Radiol. e Fis. med.*, 2, 1-25, January, 1930.

(41) SICARD and FORESTIER: *Diagnostic et Thérapeutique par Le Lipiodol*. Masson, Paris, 1928.

(42) SIMON, E.: Roentgenologic Study of the Parotid Gland. *Chirurg*, 6, 404-412, June 1, 1934.

(43) USLENGHI, J. P.: New Technic for Radiologic Investigation of the Salivary Glands. *Semana Médica*, 27, 41, July, 1925.

(44) WAKELEY, C. P. G.: The Formation of Salivary Calculi and the Method of Treatment. *Lancet*, 1, 708-711, April 6, 1929.

ROENTGEN THERAPY BY THE METHOD OF CHAOUL¹

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THE purpose of this communication is to present our experiences with the contact roentgen therapy unit which was obtained one and a half years ago through the generosity of Mr. W. H. Donner. Obviously, from such a brief experience, we can draw no definite conclusions, but we can present for your consideration certain physical data and clinical impressions, which, perhaps, may be of assistance to those who are interested in this type of therapy.

Due to technical advances in x-ray tube design, it has become possible to utilize efficiently the lower voltages (45–60 kv.) in radiation therapy. While such low voltages were attainable in the past, safe target-skin distances were so great that skin dosage rates were too low for practical use. At the present time, however, it is feasible, with modern shock-proof equipment, to use very short target-skin distances (5 cm. and less), and, thereby, to increase the skin dosage rate to practical values.

High Tension Generator.—Several reports describing the generating equipment of the Chaoul unit have already appeared in the literature (1, 6). Briefly, the x-ray tube is activated by a constant potential generator (Siemens' Monopan), using a modified Greinacher circuit. While the unit includes a constant potential generator, one can employ a pulsating generator of proper capacity to energize the tube.

X-ray Tube.—The x-ray tube is a modification of the Lenard ray tube (Fig. 1). The electron beam passes down a grounded metal cylinder, striking at the end a target of gold-plated nickel. The rays emerge through the target, which, therefore, acts as part of the filtration.

In addition, the beam passes through the cooling water (approximately 2 mm.) and a thin metal foil window, which forms part of the water jacket. The total inherent filtration, as stated by the manufacturer, is approximately equivalent to 0.2 mm. of nickel. While the rated capacity of the tube is 60 kv., 4 ma., we chose to operate at 50 kv., 4 ma., to assure ourselves of longer tube life. Factory calibrations were used to determine the settings. When the voltage was later checked with a Behr Generating Voltmeter, we discovered we were really operating at 45 kv.

Since the high tension lead is shock-proofed and the anode at ground potential, extremely short distances can be used with impunity. The shortest possible target-skin distance is 3 mm., the thickness of the water jacket. In practice, however, from 3 to 5 cm. distances are generally preferred (Fig. 2), being careful to avoid the water jacket window, which, due to its excessive thinness, is very easily punctured when the applicators are slipped into place.

Water Supply for Cooling.—For adequate cooling of the target, a flow of from 1 to 2 liters of water per minute is necessary. In order to assure this flow, water pressures dangerously close to the rupturing pressure of the foil window must be maintained. The most satisfactory water supply is one with a constant head, such as that obtained with an elevated water tank. Unfortunately, we were not able to place our water tank high enough to assure adequate flow and found it necessary, therefore, to use a reduction valve in the afferent water supply and a pressure relay in the efferent stream. Such a system insures reasonable safety, if the ordinary water supply is used.

¹ Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13–17, 1937.

PHYSICAL DATA

In view of the low voltage and the short target-skin distances employed, it was expected that the intensity gradients in a

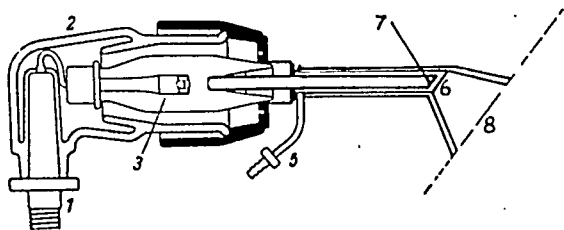


Fig. 1. Chaoul therapy tube. (1) High tension connection; (2) Porcelain housing, protection incorporated; (3) Cathode; (5) Water-cooling lead; (6) Aperture for rays; (7) Focal "spot"; (8) Patient's skin. (With permission of Mayneord.)

phantom would be too large to be followed with an ordinary dosimeter. In order to plot these gradients, Mayneord (7, 8) developed an ionization chamber with a small active volume particularly adapted to this problem (Figs. 3 and 4). Through the generosity of Dr. Mayneord and Mr. W. H. Donner, we were presented with a dosimeter of this type.

Dosimeter.—The dosimeter consists of a small ionization chamber (active volume, 3 cubic mm.) connected by a lead to a Lindemann electrometer (Fig. 3). The whole assembly is small and light, mounted on a rack and slide which permits accurate vertical and horizontal motion, to within 0.1 mm., which is ideal for measurements of steep intensity gradients. The lead to the chamber consists of a brass tube which shields the central wire, mounted within amber buttons. Ample provision has been made for the evacuation and immersion of the lead in a water phantom. In spite of the low voltage (45 kv.) with which we worked, it was necessary to evacuate this lead continuously (Cenco Hyvac), in order to minimize the effects of stray ionization in the tube (Fig. 4).

In spite of the high sensitivity of the Lindemann electrometer, it is quite rugged. The needle is viewed by transmitted light, the image being projected through a

microscope onto a ground-glass slide. Under action of the roentgen rays, charge is accumulated on the insulated measuring system and the charging rate determined in the usual manner with a stop-watch.

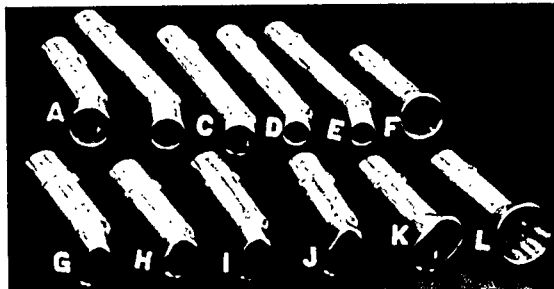


Fig. 2. Applicators supplied by manufacturer.

"A"	—5 cm.—3 cm. diam.—102 r/min.
"B"	—5 cm.—2.5 cm. " —108 r/min.
"C"	—3 cm.—2.5 cm. " —215 r/min.
"D"	—3 cm.—2 cm. " —234 r/min.
"E"	—5 cm.—2 cm. " —106 r/min.
"F"	—5 cm.—4 cm. " —110 r/min.
"G"	—5 cm.—3 × 1.3 cm. —111 r/min.
"H"	—3 cm.—3 × 2 cm. —243 r/min.
"I"	—5 cm.—4 × 1.5 cm. —110 r/min.
"J"	—5 cm.—4 × 2 cm. —108 r/min.
"K"	—5 cm.—4.5 × 2.5 cm. —110 r/min.
"L"	—5 cm.—4.6 cm. diam.— 98 r/min.

All determinations made at 45 kv., 4 ma.

Ernst, Frik, and Ott (6), Chaoul (1, 2), Morison, Hugo, and Mayneord (7, 8) have published excellent papers containing data on the physical characteristics of the rays emitted at 60 kv. by the Chaoul apparatus. Our data concern radiations produced at 45 kv. To facilitate comparison of these data, we have followed, as nearly as possible, the outline of Mayneord's observations (7). The rays were generated at a peak voltage of 45, with a ripple of 4 per cent, current being kept constant at 4 ma.

Intensity of Radiation.—The intensity in r per minute was determined by means of a Siemens' dosimeter with a special low voltage ionization chamber. This instrument was checked several times against a similar instrument standardized by the Bureau of Standards. The dosimeter, equipped with a scale indicating the output in r per minute, was, in our experience, subject to considerable variation. Anyone using such a dosimeter should be aware of

the inaccuracy of its calibration in absolute units. If, however, proper corrective factors are supplied by the Bureau of Standards, such an instrument can be used for absolute measurements.

kv., with a similar filter, the intensity is 61 r per minute at the same target-skin distance.

Measurements were made to determine whether or not small masses of vaseline,

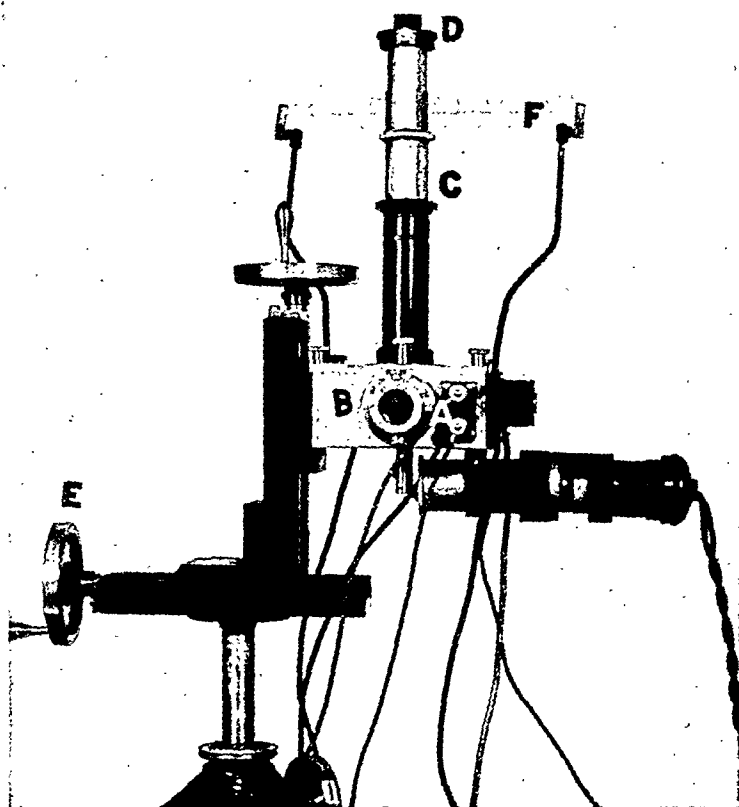


Fig. 3. Mayneord dosimeter. (A) Entrance for lead into electrometer; (B) Electrometer; (C) Telescope; (D) Prism; (E) Set screws for slide and rack to move electrometer; (F) Ground glass rule.

In stating average values of intensity of radiation, one is confronted with large variations in output between x-ray tubes. These variations may be as high as 50 per cent. However, in carefully chosen tubes, we have found the average output to be from 90 to 100 r per minute at 5 cm.; from 200 to 245 r at 3 cm., and an estimated 2,000 r per minute at contact (3 mm.). (See Fig. 12.) It should be emphasized that the high intensities are due to the short distances used. At 50 cm. distance, the intensity is approximately 1 r per minute, whereas at 200

used to lubricate the applicators, would influence the output if interposed in the beam. The results indicated that reasonable quantities of vaseline had negligible effects upon the intensity of the energizing beam.

Quality of Radiation.—The absorption curve is regarded as acceptable for specifying x-ray quality (9, 11). In view of this, we elected to limit ourselves to this method.

Half Value Layer.—The absorption curve was determined in aluminum, since measurements in copper at this voltage

are inaccurate. These data (Fig. 5) reveal the half value layer to be 2.4 mm. aluminum. From the semi-logarithmic curve (Fig. 5), the effective wave length was found to be 0.38 Å. This was cal-

40 per cent). This may be attributed to various phenomena. Mayneord called attention to the increased filtration as the angle of emergence deviates from 90 degrees. Another concerns the long path of

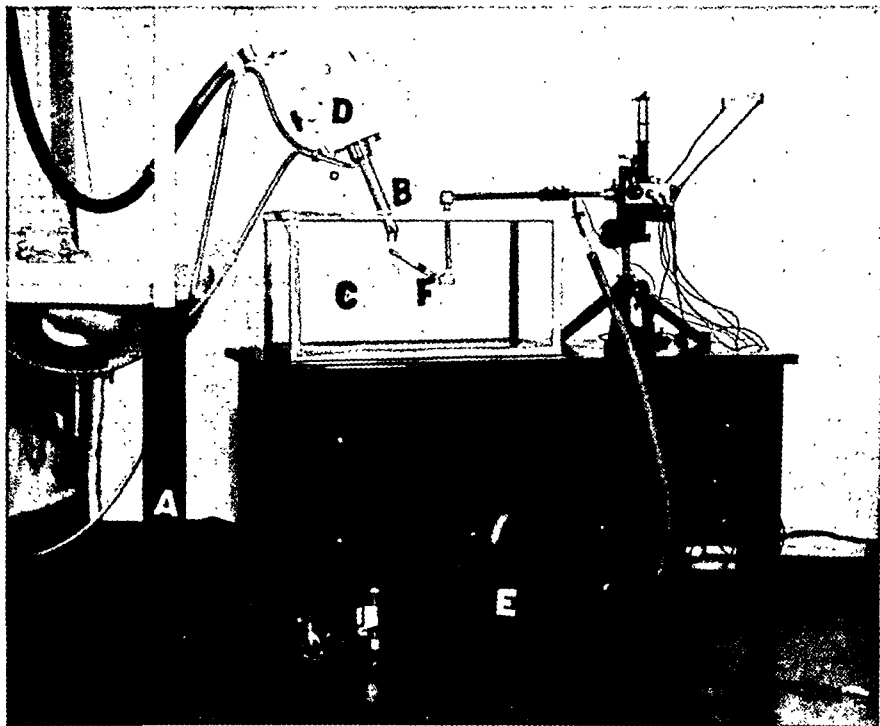


Fig. 4. Apparatus used to determine intensity distributions. (A) Stand holding contact tube; (B) Anode portion of tube; (C) Water phantom; (D) Porcelain holder for tube; (E) Hyvac pump; (F) Ionization chamber and lead to electrometer.

culated from the slope of the straight portion of the curve by means of the formula:

$$\frac{U}{2.7} = 14.453 + 0.15(10).$$

Focal Spot.—Pin-hole photographs of the focal spot revealed it to be approximately 1.6 cm. in diameter. The focal spot picture was made through a pin-hole 0.4 mm. in diameter (Fig. 6). The focal-pin-hole distance was 24 inches (61 cm.); and the pin-hole-film distance, 12 in. (30.5 cm.). The exposure time was 45 minutes at 45 kv., 4 ma.

Radial Variations in Intensity.—The radial variation of intensity was determined in air and in a water phantom (Fig. 7). We found that the intensity falls off toward the periphery of the field (30 to

the cathode-ray beam, which makes focusing difficult. In addition, the grounded metal cylinder attracts electrons, which decreases their density in the periphery of the beam.

Variation of Intensity with Distance.—The inverse square law of variation with distance could not be assumed to hold with such a large focal spot at short distances. Our investigations, however, revealed that there was a close agreement between the inverse square law and the experimental results (Fig. 8).

Back-scatter.—The surface back-scatter was determined by first measuring the intensity, in air, in the plane of the end of an applicator. The intensity was then measured at the surface of a water phantom (the chamber being half submerged),

method. Since adopting this plan, we are no longer being troubled by the severe reactions produced by exit radiation. It has been our experience that approximately 2,500 r, if delivered in one dose, is suf-

young individuals respond favorably to small doses repeated over a period of time. Usually from 250 to 350 r, repeated at four- to six-week intervals on three or four occasions, suffice. Sometimes, two treat-

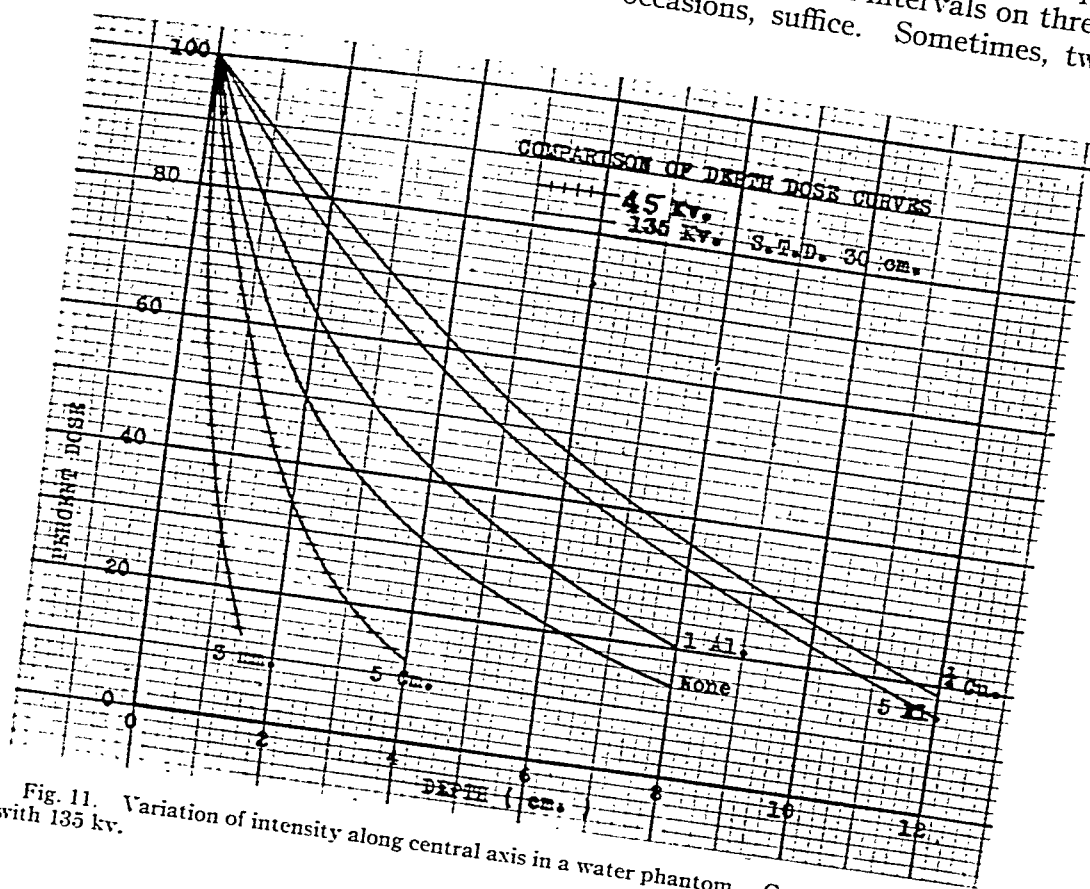


Fig. 11. Variation of intensity along central axis in a water phantom. Comparison of 45 kv. with 135 kv.

ficient to remove 98 per cent of the warts. This amount of radiation, delivered at 3 mm. target-skin distance, requires less than one minute, whereas formerly it required approximately 25 minutes (1,500 r with unfiltered radiation plus 1,100 r with 1 mm. aluminum).

Keloids.—For years we have satisfactorily treated keloids, employing the following factors: 135 kv., 30 to 40 cm. total skin distance. This technic has been replaced by contact therapy with results comparable to those obtained at 135 kv. The older method is still used for large keloids, as the greater target-skin distances enable one to include the entire lesion in the one field.

As a rule, rapidly growing keloids in

ments are adequate, whereas in other patients as many as eight treatments are insufficient. No rule of thumb governs keloids. One must be guided entirely by the individual lesion and its response to radiation, allowing enough time—months—to elapse in order to avoid excessive treatment.

Vernal Catarrh.—Several years ago, one of us (E. P. P., 12) reported the results in the treatment of vernal catarrh by means of radium and radium emanation. At that time, we recommended these agents because they were more easily applied than the roentgen rays. This technic has now been replaced, to a large extent, by contact roentgen therapy, because of the more even distribution of its energy. The ease

with which the target is applied to the eye is equal to the ease with which emanation was utilized.

After anesthetizing the eyes, the lids are everted and plastic lead applied to the

eyelashes for protection. A special instrument, used to evert the lid, serves as protection to the globe. Each eye is treated at from 3 to 4 cm. distance, delivering about 250 to 300 r in from one and

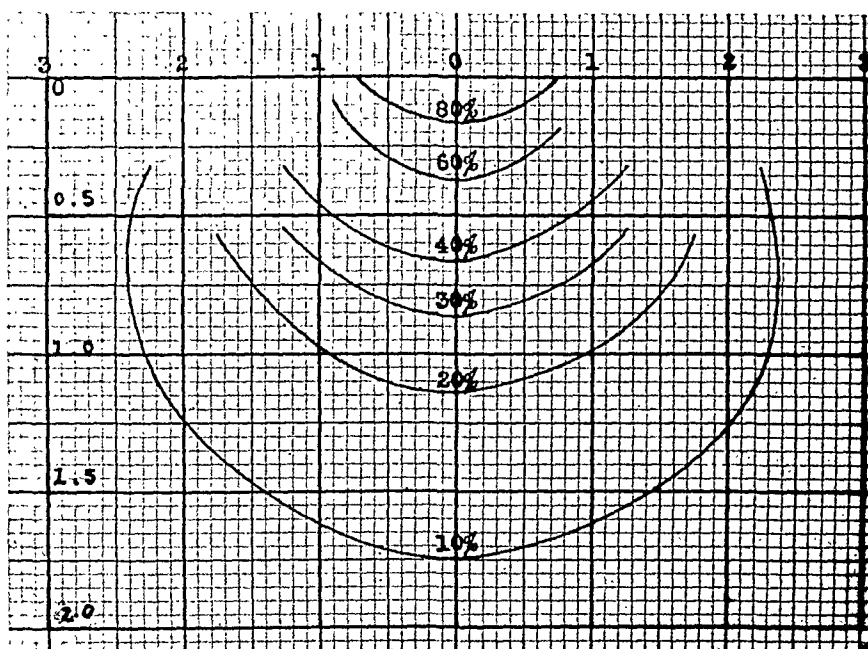


Fig. 12. Isodose contours for contact—3 mm. (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

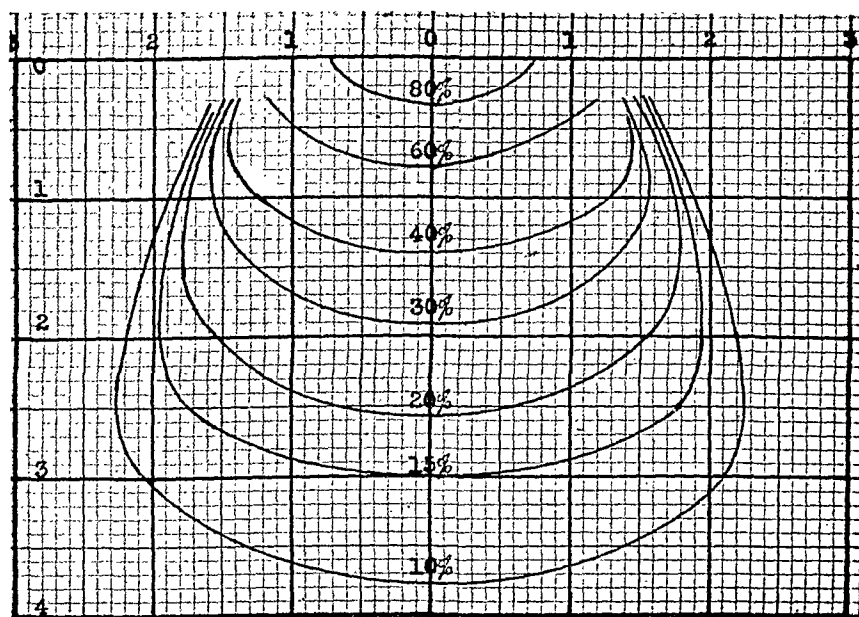


Fig. 13. Isodose contours for 3 cm. T.S.D. Applicator "C" (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

one-half to two minutes. A similar treatment is usually repeated in from four to six weeks, following which several months are allowed to elapse. We have given four such treatments to each eye, over a period

where do we use it with more satisfaction than for infections around the eyes, nose, and ears. These areas are particularly suited for the various applicators. Daily doses of from 100 to 200 r usually suffice if

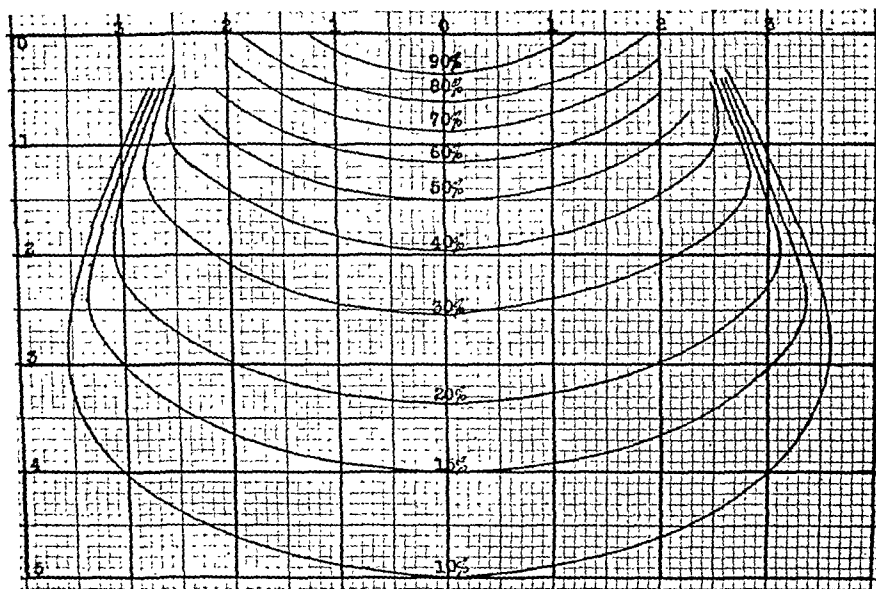


Fig. 14. Isodose contours for 5 cm. T.S.D. Applicator "L" (45 kv., 4 ma.). Abscissæ, radial distance in centimeters; Ordinates, depth in centimeters.

of one year, before obtaining the desired results. The limitations and prognosis with Chaoul therapy are similar to those already discussed for radium and emanation.

Anal Conditions: Pruritus Ani.—The ease with which the applicator is fitted to the anus recommends its use in this condition. Doses of 200 r, repeated once or twice at twenty-four-hour intervals, are usually sufficient to relieve the itching.

Rectal Condylomas.—Doses of 200 r, repeated daily over a period of from four to five days, are usually sufficient to remove these lesions. As a rule, these warts regress slowly over a period of about four weeks until they are no longer visible. The itching which frequently attends these venereal lesions disappears within the first few days.

Infections.—We have used low voltage therapy successfully in the treatment of small infections all over the body, but no-

repeated once or twice, although somewhat higher doses are necessary in the treatment of axillary infections.

Evidence is now accumulating which points to the small lymphoid tufts scattered irregularly over the nasal and oral pharynx as important foci of infection. The ease with which these areas can be treated through the mouth by means of the low voltage technic may, in the future, be responsible for selecting it as a method of choice.

Malignancy.—Our experience with Chaoul therapy for neoplasms is almost entirely limited to lesions of the skin, lips, and easily accessible portions of the mouth. We have purposely avoided more difficult lesions. As our experience increases, it is our plan to include such lesions elsewhere as may be susceptible to this type of therapeutic approach.

We have treated approximately thirty malignancies, with very satisfactory re-

sults. Failures occurred in two patients whose lesions were far advanced. In these patients, the more superficial portions of the lesions healed, whereas the deeper portions were unaffected. This

comes erythematous and less indurated. The lesion gradually disappears as the total dose approaches 6,000 r. With experience, one can usually tell when enough radiation has been delivered by the "feel"

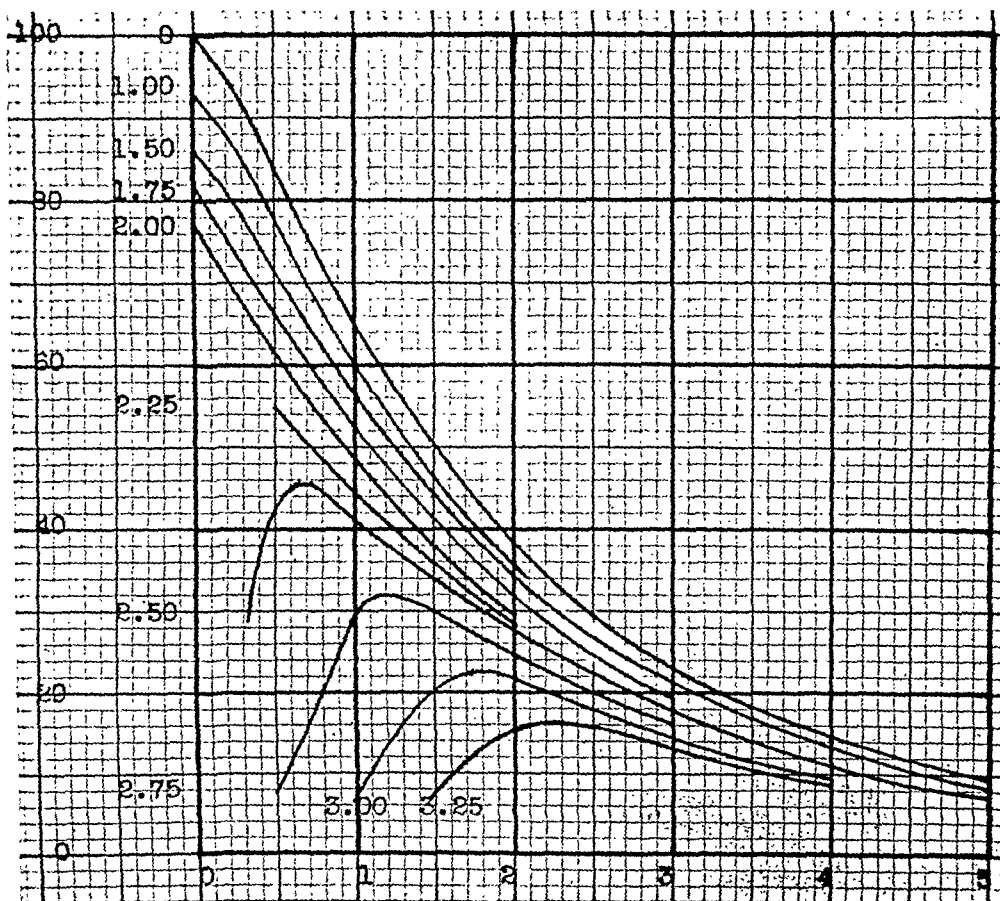


Fig. 15. Variation of intensity along various vertical axes. Applicator "L" (45 kv., 4 ma.). Ordinates, percent dose; Abscissae, depth in centimeters; Designations on curves, radial distance in centimeters.

experience would seem to indicate that deep lesions are not susceptible to this type of therapy alone.

Most early superficial cancers may be adequately treated through one portal. The larger lesions, requiring multiple ports, are more difficult because portals must be planned to compensate for the radial drop in intensity. As a rule, each portal receives from 300 to 400 r daily. If multiple portals are employed, each portal is treated daily. Changes in the lesion and healthy skin are usually manifest by the fourth to sixth day. The entire area be-

comes erythematous and less indurated. While from 6,000 to 7,000 r ordinarily suffice, we have given 9,000 r, fractionated over a period of 30 days, before complete regression of the malignancy was obtained.

Lip Cancers.—These lesions may require one or more portals. Each field receives from 300 to 400 r at each sitting. The total dose depends upon one's clinical judgment, as it varies for different tumors. In most instances, from 8,000 to 10,000 r as a total dose has produced complete regression.

We have not been able to use the Chaoul

apparatus for intra-oral carcinomas as freely as one would expect. While the unit is extremely flexible, certain portions of the mouth—the posterior, gingival, and external gingival surfaces—are not easily approached with the applicator. These inaccessible regions are still being treated with radium and high voltage radiation. In some instances, the other portions of the mouth and buccal mucosa are treated with the contact therapy machine. Whenever indicated, interstitial radium, radon, or high voltage external radiation are used to supplement intra-oral applications.

The daily dose is of the same intensity as that delivered for lip and skin cancers. The total dose usually approaches 8,000 r, but here, again, one is governed by the reaction. While patients complain of burning during the height of reaction, the pain is not so diffuse or so severe as with high voltage radiation.

The small size of the applicator makes the use of the Chaoul unit unsatisfactory for the treatment of large lesions. The time taken to treat multiple ports, and the lack of uniformity of radiation in each treated portal, militate against its use in such instances. These large areas are treated best at greater distances, in order to insure more uniform distribution of radiation.

Orbital malignancies are particularly well suited to treatment with the Chaoul unit. The ease with which the eye is approached, and the short time (from one to three minutes) necessary for each treatment, when considered in the light of its energy distribution, make the Chaoul technic preferable to other types of radiation. When necessary, portals can be shaped exactly to fit the lesion, allowing one to use extremely high doses without

ill effects. One patient received 8,200 r (portal 1 cm. in diameter), directed into the sclera, over a period of 30 days, without subjective or objective ocular changes. This patient's vision and fundal studies have remained unaffected for over one year.

SUMMARY

Low voltage therapy (Chaoul technic) is indicated as a procedure of choice in lesions so situated that short treatments are desirable.

It is a satisfactory therapeutic procedure in selected cases in which it is desirable to obtain the maximum amount of effect in the superficial tissues.

BIBLIOGRAPHY

- (1) CHAUL, H., and ADAM, A.: Die Röntgen-nahbestrahlung maligner Tumoren. *Strahlentherapie*, 48, 31-50, 1933.
- (2) CHAUL, H.: Die Behandlung bösartiger Geschwülste durch eine der Radiumtherapie angepasste Röntgenbestrahlung. *München. med. Wchnschr.*, 81, 235-239, Feb. 16, 1934.
- (3) Idem: Bemerkungen zu der Arbeit von Schaefer und Witte. *Strahlentherapie*, 49, 718, 719, 1934.
- (4) Idem: Die Röntgennahbestrahlung des Lippenkrebses. *Strahlentherapie*, 52, 221-225, 1935.
- (5) Idem: Die Behandlung bösartiger Geschwülste mit der konzentriertfraktionierten Nahbestrahlung. *Strahlentherapie*, 53, 202-209, 1935.
- (6) ERNST, H. W., FRIK, K., and OTT, P.: Messungen räumlicher Dosisverteilung bei Nahbestrahlungen. *Strahlentherapie*, 52, 389-402, 1935.
- (7) MAYNEORD, W. V.: Measurements of Low Voltage X-rays. *British Jour. Radiol.*, 9, 215-238, April, 1936.
- (8) MORISON, J. W., HUGO, D., and MAYNEORD, W. V.: A Preliminary Note on Low Voltage X-ray Therapy. *British Med. Jour.*, 2, 783, 784, Oct. 26, 1935.
- (9) TAYLOR, L. S.: Absorption Measurements of the X-ray General Radiation. *RADIOLOGY*, 16, 302-321, March, 1931.
- (10) DUGGAR, B. M.: *Biological Effects of Radiation*. McGraw-Hill Book Co., New York, 1936.
- (11) WILSEY, R. B.: On the Specification of X-ray Quality. *RADIOLOGY*, 17, 700-713, October, 1931.
- (12) PENDERGRASS, E. P., and ANDREWS, J. R.: Radium Emanation Treatment of Vernal Catarrh. *Am. Jour. Roentgenol. and Rad. Ther.*, 34, 637-640, November, 1935.

CHOLECYSTOGRAPHY: THE SINGLE-DOSE *VERSUS* THE DOUBLE-DOSE METHODS OF ADMINISTERING THE DYE

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IN recent years there has been a tendency to improve the roentgen technic in cholecystography, especially in the dosage of the dye and the time of its administration. It is now generally agreed that the increase in the dosage of tetraiodophenolphthalein has materially improved the density of the gall-bladder shadow. However, there are still some controversial opinions as to how the dye should be administered, whether by the single- or the double-dose method. In order to determine the efficacy of either one of the methods of administration, a series of 200 normal cases were studied: 100 by the single-dose method, and 100 by the double-dose procedure.

In 1926, Morrison and the writer (1) recommended that the maximum dosage of tetraiodophenolphthalein should be given in divided doses to obtain the greatest uniformity of density of the vesicular shadow, as well as to eliminate some of the untoward reactions following its administration. In a more recent communication (2) a minimum dosage of six grams of dye administered in a single dose was advocated, in order to produce uniform gall-bladder shadows of good density and to simplify the mode of administration. Since then, others have recommended the administration of a similar dosage, and some now recommend a larger dose. However, it has been pointed out that the larger dosage is more effective when administered in two doses at different intervals. Thus the so-called double-dose method is now being advocated as one superior to the single-dose procedure.

In 100 cases in which the single-dose method was utilized, a minimum dose of six grams of tetraiodophenolphthalein was administered to those patients weighing up to 160 pounds; nine grams to those weighing from 160 to 200 pounds, and 12 grams to those weighing over 200 pounds. The

dye was administered by the technician or roentgenologist, from one to two hours after the ingestion of a cup of tea and two slices of toast.

In the double-dose method, three grams of dye were administered at noon and three grams at 6 P.M. An additional dose of dye was given at 9 P.M. to those weighing over 175 pounds, in order to equalize the dosage factor in the two series.

With the exception of the method of administration of the dye, the technic was carried out similarly in both series. A patient was allowed only water, orange or pineapple juice. If the patient complained of diarrhea or a tendency to loose bowels, two teaspoonsful of paregoric were given immediately following the initial dose of the dye. Otherwise, paregoric need not be given as a routine measure. On the next morning the patient was instructed to drink a glass of water, and to take an enema before coming for the x-ray examination.

This routine study permitted us to obtain accurate information regarding the effects of the different dosages of dye as well as the advantages or disadvantages of the single- or double-dose method of administration.

As a result of this study, it was found that reactions following the administration of the dye by either method did not differ significantly. However, the advantage of the single dose as far as the effects of the dye are concerned, proved, in our experience, to be a more favorable procedure. In the majority of cases there were a few symptoms such as mild nausea; rarely vomiting; and three or four bowel movements. When these symptoms occurred, the patient experienced them only once, whereas if the two doses were given separately, not infrequently there were two periods of reactions—one after each dose. In the double-dose method there may be no reaction at all following the first dose, but it may occur

after the second dose, or *vice versa*. Another disadvantage of the double-dose procedure which is not infrequently experienced, is that if the patient is greatly alarmed by the symptoms following the first dose of dye, the second dose may not be taken for fear of further reactions. On the whole, however, these studies have clearly shown that the occurrence of symptoms in the majority of cases are negligible, regardless of how or when the dye is administered. It has also been shown that the additional amount of dye administered by giving the larger dosage by either method is not as a rule disturbing to the patient.

A comparison of the density of the vesicular shadows was carefully made in each series of cases to determine whether or not the method of administration produced any material difference between the two procedures. An analysis of the 200 cases yielded such similarity of cholecystographic pictures that one can definitely state there to be no noticeable difference in the shadows to warrant the double-dose procedure. This study proved beyond doubt that the single-dose method of administering the dye produces good diagnostic vesicular shadows, in the normal case, in every instance.

It is noteworthy to direct attention to the fact that one of the main features of the double-dose method is that this procedure allows a greater period of absorption of the dye from the intestine. Theoretically, however, this procedure should produce a superior cholecystogram, since probably more of the dye is absorbed from the intestine. Notwithstanding this factor, it has not been proven that more of the dye has actually been absorbed.

Since the diagnostic evaluation of the cholecystographic shadows in the two series

of cases were similar, the single-dose method offers the advantage of simplicity.

CONCLUSIONS

1. The diagnostic results following the administration of a large single dose of tetraiodophenolphthalein in cholecystographic studies of the gall bladder do not differ in any way from those of the double-dose method.

2. The single-dose method simplifies the cholecystographic test. The dye is given by the technician or roentgenologist, making certain that the full amount of the dye is administered at a definite time.

3. The double-dose method offers no superior shadows over those obtained by the single-dose procedure.

4. The double-dose method does not prevent or lessen the reactions of the dye upon the digestive tract.

5. The large single-dose method does not as a rule produce any uncertainties in the production of diagnostic vesicular shadows, nor does it require retakes if the technic is carried out properly.

6. The prolonged period of absorption of the dye from the intestine is theoretically of some advantage, but is not necessary, except in cases of extreme diarrhea, for the production of normal vesicular shadows.

7. Regardless of whether the single-dose or the double-dose method is utilized, good results may be secured by either procedure, providing enough of the dye is administered.

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REFERENCES

- (1) MORRISON, T. H., and FELDMAN, M.: Gall-bladder Visualization by the Oral Administration of Tetraiodophenolphthalein. *Ann. Clin. Med.*, 5, 330, 1926.
- (2) FELDMAN, M.: Oral Cholecystography. *Am. Jour. Roentgenol. and Rad. Ther.*, 31, 227-229, February, 1934.

THE INFLUENCE OF ULTRA-VIOLET RAYS ON THE BODY WEIGHT

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THE experiments reported in this paper are meant to be a contribution to the problem of general ray-reaction, the results of which appear to have a theoretical interest as well as a practical one.

METHODS

A total of 141 white mice were used, all of the male sex. There were two series: Series A was abundantly nourished, being fed 32 gm. bread per week—*i.e.*, 8 gm. each Monday and Wednesday and 16 gm. on Friday. Series B was scantily nourished, being fed 16 gm. bread per week—*i.e.*, 4 gm. each Monday and Wednesday and 8 gm. on Friday. Water was supplied to both series *ad libitum*. In Series A, 45 mice were radiated while 34 served as controls. In Series B, 32 mice were irradiated while 34 served as controls.

The radiation took place daily except Thursday and Sunday. As a light source we used the mercury vapor lamp, type S 500 (Hanauer Quarzlampengesellschaft), with the reflector pushed forward. The radiation time varied from five to eight minutes; the distance was 40 centimeters. The mice were kept in a tin box with a wire cover. During radiation the temperature on the bottom of the box was about 38° C.

RESULTS

I. *Determination of the Radiation Dosage.*—The determination of the radiation dosage was made with the aid of a photo-electric cell (zinc cell). With the aid of this cell (1), comparative measurements were carried out between the lamp Type S 300 and the one of the Type S 500 used here. Unpublished experiments have shown that Type S 300 is equal in its intensity to the older type used in our earlier experiments (2) for the determination of the erythema threshold value. For ten

parts of the scale on the electrometer, we found the following time averages with diaphragms of 3.5 mm.:

[S 500 in 40 cm. distance reflector forward	11.6 sec.
[S 300 in 25 cm. distance reflector back	11.3 sec.

Under the above-mentioned conditions these two lamps were, therefore, to be considered as equal in intensity. The required distance was thus determined.

For the determination of radiation time, however, it was furthermore necessary to account for the diminution of the radiation through the wire cover. For this purpose we chose three wire covers and fixed them in front of the diaphragms. Then we measured the time for ten parts of the scale of the electrometer, using the lamp S 500 at 40 cm. distance. Table I gives the time averages received.

TABLE I

S 500 without wire cover	12.2 seconds
S 500 with wire cover A	21.5 seconds
S 500 with wire cover B	22.5 seconds
S 500 with wire cover C	21.8 seconds

Thus it appears that the wire cover diminishes the intensity by about 50 per cent.

Our experience has shown us that with a lamp of the Type S 300 at 25 cm. distance (reflector pushed back) about 100 seconds are sufficient to produce a threshold-erythema of the human skin on the forearm. Now, supposing that the sensibility of the human skin on the inside of the forearm is equal to that of the skin of mice on ears and tail, a dosage of 200 seconds with S 500, under the same conditions as above, should be sufficient to produce such an erythema on mice. However, it appeared that 200 seconds were not enough. Therefore, we began our radiation anew, this time at 40 cm. distance and 300 seconds (5 minutes). After 24 hours this dosage effected in the majority of the mice a weak erythema of the tails and ears, and after a

second radiation, this erythema appeared more clearly.

II. Influence of the Nutrition and Radia-

on the point marked by arrow, we succeeded in stopping once more the rising of the weight curve of the radiated animals.

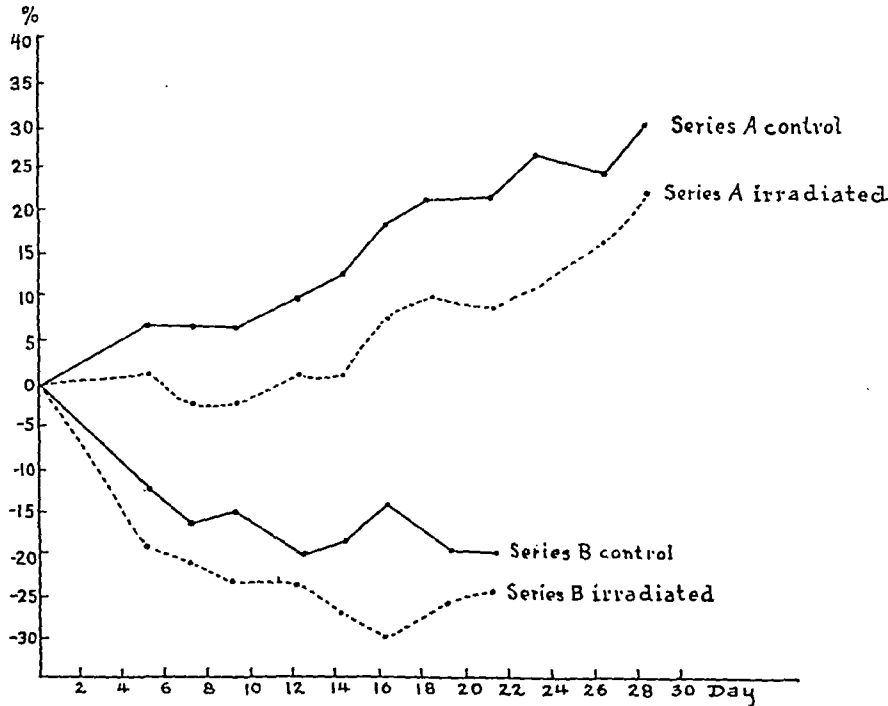


Fig. 1.

tion on the Body Weight.—Our results on the influence of nutrition and radiation are contained in Figure 1. The ordinate indicates the increase or decrease of the body weight in percentage of the body weight at the beginning of the experiments; the abscissa indicates the time. Table II indicates in parentheses the number of animals from which the weight averages, used in Figure 1, were calculated.

As can be seen from Table II, the ultra-violet radiation causes in both series a weight loss which, however, diminishes in both series after about fourteen days, so that the weight curves of the radiated animals approach again that of the non-radiated ones.

It is very interesting to see that this weight loss on the part of the radiated animals is apparently connected with the development of the erythema, as shown in Figure 2. In this experiment by increasing the radiation time from six to eight minutes

DISCUSSION OF THE EXPERIMENTS

The weight losses found in our experiments could be explained only by an increase of metabolism and thus directed our attention to the thyroid gland, the increased activity of which might be the cause of this increased metabolism.

Such an increased activity of the thyroid gland as a result of radiation has been found by a number of authors (listed in Laurens, 3, and Ellinger, 4). However,

TABLE II

Day	Series A		Series B	
	Control	Radiated	Control	Radiated
5	+6% (34)	+1% (45)	-13% (34)	-19% (32)
7	+6% (34)	-2% (43)	-16% (34)	-21% (31)
9	+6% (34)	-2% (39)	-15% (22)	-23% (23)
12	+10% (24)	+1% (28)	-20% (31)	-23% (19)
14	+13% (24)	+1% (28)	-18% (30)	-27% (12)
16	+18% (18)	+7% (15)	-14% (14)	-29% (11)
18	+21% (18)	+10% (13)	-19% (19)	-25% (11)
21	+21% (18)	+9% (12)	-20% (19)	-24% (10)
23	+27% (18)	+11% (12)		
26	+24% (18)	+16% (9)		
28	+31% (18)	+23% (9)		

there are some experiments the results of which lack such an effect (Mayerson, 5).

In the hope of getting further insight

seem to us, however, to be quite interesting in connection with our results from the course of the weight curve as well as from

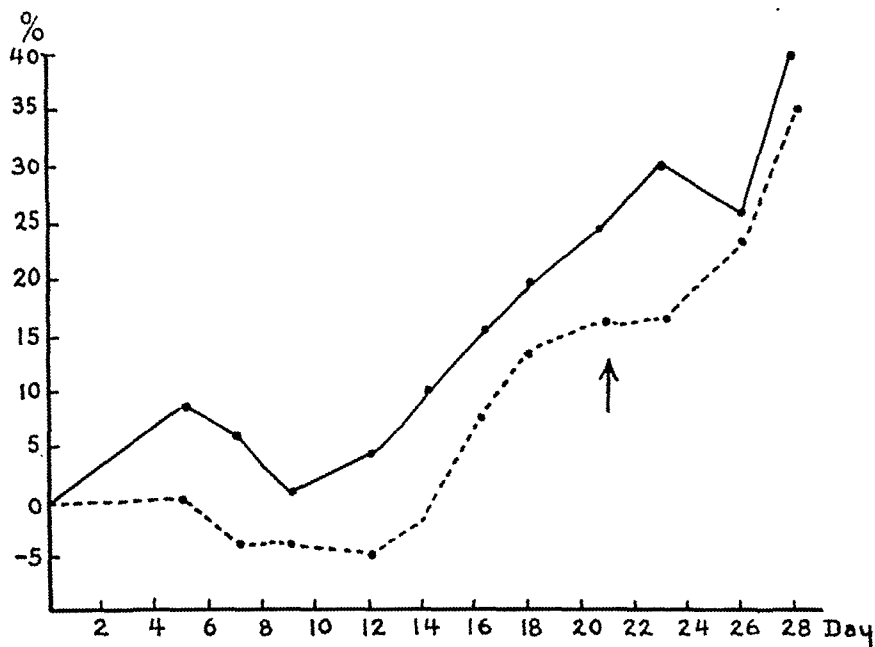


Fig. 2.

into the state of function of the thyroid gland in our experiments we applied the acetoneitril test for thyroid, after Reid Hunt (6), to some of the mice. For this purpose a 2 per cent solution of acetoneitril was used for a subcutaneous injection. The solution was prepared fresh each time. The dosage was 1.5 mg./gm. body weight. As a preliminary communication we publish our results in Table III.

TABLE III.—(ACETONEITRIL TEST)

Radiation for Days	Dead after 24 Hours		Reaction after Reid Hunt
	Radiated Animals	Controls	
5	6 from 10	2 from 9	negative
10	6 from 10	7 from 10	positive (?)
14	7 from 12	5 from 6	positive
28	6 from 6	6 from 10	negative

Therefore, it seems as if really in the second week the decrease of the weight curve is accompanied by a parallel increase of the activity of the thyroid gland. For the time being, however, we want to report with all reserves, intending to secure them by further systematical research¹. They

other points of view. An increase in the tolerance of radiated white mice toward acetoneitril has already been described by Bruman and Blomberg (7). An intimation of such an effect was also described by Riesser and Hadrossek (8). Bruman and Blomberg were able to reach the same findings, concluding that there is an increase in the activity of the thyroid gland as well by ultra-violet rays as by vitamin D doses. They declare, therefore, that formation of vitamin D in the skin is the primary process of this secondary ultra-violet ray reaction on the thyroid gland. We do not agree with this suggestion, and for the following reasons:

It appears from our findings reported above (mainly Fig. 2) that the change in the weight curve apparently is a function of the radiation time and thus influenced by the degree to which the skin is light-accustomed. This seems, in my opinion, to point to the fact that here the formation of histamine-like substances is to be made responsible for this secondary radiation effect. For, if the vitamin D formation were in question, then the photochemical

¹ In the meantime these preliminary results are secured by further experiments as reported in *Acta Radiologica*, 3, 195, 1938.

formation of the vitamin D in the skin would always have to be the same with the same radiation dosage, because this process must take place in the fatty substances of the skin and must, therefore, be independent of the degree to which the skin is light-accustomed.

The formation of histamine-like substances is, however, dependent on the increasing thickness of the horn-cell layer of the skin under the ultra-violet radiation, depending, therefore, on the degree to which the skin is already light-accustomed.

Thus it seems that our weight curve as well as preliminary results of the acetonitril test of radiated animals offer a new argument for the histamine theory of the ray effects, and at the same time our suggestion that histamine-like substances are playing a decisive rôle could explain the conflicting results of the authors on the outcome of the acetonitril test by radiated mice.

Besides the possibility of the influence of the thyroid gland on the metabolism we must also take in consideration the possible influence of the thyrotropic hormone of the pituitary gland (Paal, 9).

Whatever the explanation of our results might be after further research, the following practical conclusions can already be drawn.

The application of ultra-violet rays and the prevention of a higher degree of be-

coming light-accustomed, combined with scanty caloric nutrition, might be recommended also for producing a weight decrease in the human body for therapeutical purposes, a proposition which, considering the degree to which the human body is light-accustomed, is easy to be realized.

SUMMARY

A weight decrease in white mice was found after radiation with ultra-violet light under certain conditions of nutrition, and an increase in the activity of thyroid gland was made responsible for these results. This seems to provide an additional basis for the histamine theory of the ray-reaction, and has perhaps some bearing on the treatment of certain kinds of adiposity.

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REFERENCES

- (1) FRIEDRICH, W., and SCHULZE, R.: *Strahlentherapie*, 50, 369-398, 1934.
- (2) ELLINGER, F.: *Strahlentherapie*, 44, 1-82, 1932.
- (3) LAURENS, H.: *The Physiological Effects of Radiant Energy*. New York, 1933.
- (4) ELLINGER, F.: *Die biologischen Grundlagen der Strahlenbehandlung*. Berlin-Vienna, 1935.
- (5) MAYERSON, H. S.: *Am. Jour. Physiol.*, 113, 659-662, November, 1935.
- (6) HUNT, R.: *Am. Jour. Physiol.*, 63, 257, 1923.
- (7) BRUMAN, F., and BLOMBERG, A.: *Ztschr. f. ges. exper. Med.*, 97, 229, 1935.
- (8) RIESSER, O., and HADROSSEK, A.: *Arch. f. exper. Path. u. Pharmacol.*, 155, 139-159, 1930.
- (9) PAAL, H.: *Klin. Wchnschr.*, 12, 1988, 1989, Dec. 30, 1933.

THE TREATMENT OF CARCINOMA OF THE BREAST

TECHNIC, COMPLICATIONS, AND RESULTS¹

By ELIZABETH NEWCOMER, M.D., *Denver, Colorado*

THE treatment of cancer of the breast is a complicated problem. For years surgery was the only solution, and a few surgeons still believe it to be the only solution. Most of the surgeons to-day, however, feel that some form of irradiation must be combined with surgery in the treatment of cancer of the breast.

Surgeons divide cancer of the breast into two groups, namely, operable and inoperable; but differ widely as to what constitutes operability.

If the tumor is small and movable, localized within the breast with no palpable axillary nodes, the general method of treatment to-day in a proven case of carcinoma is the radical removal of the breast. A simple mastectomy would probably be sufficient when the cancer is confined to the breast, if it were not for the chance of error in the clinical diagnosis.

In a study of cases by Harrington (6) in which there were no palpable lymph nodes, 29 per cent were found to have metastases at operation. White (12), in his analysis of 195 operable cases, found that 38 per cent had clinical axillary disease, but a careful microscopic examination proved 51 per cent to have axillary metastases.

Radical surgical removal is therefore indicated in all cancers of the breast in this early stage. This must be thorough and should destroy all the cancer-bearing area. Incomplete or careless operation, soiling of tissues during the operation, and carelessness in obtaining a specimen for diagnosis may result in recurrence or metastasis.

The percentage of five-year cures of carcinoma of the breast, when the disease is confined to the breast, varies with differ-

ent surgeons, but the average taken from available statistics is 70 per cent.

The real problem confronting the surgeon is the curability of cancer of the breast when the axillary nodes are invaded. The percentage of five-year cures drops markedly when the disease is in this stage, and only from 25 to 28 per cent will be alive and well after five years. Portmann (9), in his statistics compiled from reports in the literature, gives the percentages as varying from 15 to 52.1 per cent, the mean average being 28 per cent.

In the late stage of the disease in which there are supraclavicular or distant metastases or recurrences following incomplete surgery, further operation will seldom result in a cure or in the prolongation of the life of the patient. A five-year survival after operation in this stage is very rare.

To recapitulate: With radical surgery, 70 per cent of five-year cures can be obtained if the cancer is confined to the breast, and only 28 per cent if the axillary glands are involved. These percentages have varied but little since the first radical operation was described; therefore, little further improvement can be expected by surgery alone.

The next question then is, can the radiologist produce any additional results in the treatment of cancer of the breast?

The use of x-rays in the treatment of cancer of the breast practically began in 1914 with the advent of the Coolidge tube. In the beginning only low voltage, low dosage, and light filtration were used, and the dosage and methods of treatment had to be devised from experience and from the results obtained. This has been a slow process, technics have been changed from year to year, and no uniform method of roentgen therapy of the breast is used even to-day.

¹ Presented before the Fourth Midsummer Radiological Conference, Aug. 11-13, 1938, at Denver, Colorado.

Portmann (9) says: "As a matter of fact, roentgen therapeutic methods have progressed so rapidly in the last fifteen years, due to improvements in apparatus and knowledge of the physical and biological effects, that it might be justifiable to maintain that radical irradiation as compared with radical operation for carcinoma of the breast did not begin until after 1930. At that time, a technic was developed for protracted irradiation administered in small daily doses according to the growth rate of neoplastic cells until an intensive treatment is given that is known to be effectively carcinolytic."

The results obtained by the early methods of x-ray treatment can, therefore, hardly be compared with the results obtained in the last eight to ten years, as the earlier treatments were not given in the same massive doses as those of to-day.

Radiation Therapy.—There are many problems that arise in the treatment of mammary cancer by radiation.

The radiological problem is to prevent recurrences in the operative field, including the axilla, and to prevent extension to adjacent and distant portions of the body. Sufficient irradiation must be used to destroy or devitalize the malignant cells even at the risk of possible damage to surrounding normal tissues.

According to Crile (4), local recurrences occur in 37.31 per cent. Metastases occur to the lungs in 18.65 per cent; mediastinum, 2.88 per cent; supraclavicular area, 7.88 per cent.

It is obvious that adequate treatment must be applied to the breast, axilla, lung, mediastinum, and supraclavicular area of the affected side if recurrences or metastases are to be prevented.

The technical problem is no mean one. Voltages used by recognized radiologists in the treatment of cancer of the breast vary from 135 kv. to 200 kv. and even higher. Many radiologists use 200 kv. for the axilla and mediastinum, and the lower voltages over the lungs for fear of injuring them. Those using the lower voltages, treating directly over the breast and chest, reason

that the lack of penetration of the lower voltages will prevent injury to the lungs and pleura. Following Holfelder and Hintze, many use the tangential method for treating the breast, generally using 200 kv., attempting to deliver a lethal dose to the chest wall without injuring the lung. Of the two methods, the 200 kv. tangential method is the more logical.

Filtration varies from 2 mm. to 6 mm. of Al in the lower voltages, and from 0.5 to 3 mm. of Cu plus Al in the 200 kv. technic.

The distance factor varies from 30 to 40 cm. in the low voltage, to 50 cm. in the 200 kv. technic. Greater distances are generally deemed unnecessary in treating cancer of the breast, but are sometimes used.

Methods of Administration.—There are three important methods of administration, as follows:

1. The intensive single-dose method, which has been largely abandoned.

2. Intensive fractional dose method. This technic, as used by G. E. Richards (10), consists in dividing the total dose to be given into a number of fractions. For convenience, the dose is divided into six fractions, one-sixth of the total dose to be given every 24 hours if the patient tolerates the treatments. He states that "by thus spreading the treatments over six days with 24 hours between each, the time required in radiation minutes to obtain an erythema (600 r) must be increased and an adjustment made accordingly. This adjustment is approximately an addition of 20 per cent."

3. Divided dose method. Pfahler (8), in his Caldwell Lecture, has an excellent description of this method as used by him. He gives both pre- and post-operative x-ray treatments. He uses four portals, except in stout persons, and aims to give 900 r to each portal in the pre-operative treatment over a period of two weeks, using the 200 kv. technic. For the post-operative treatment, he uses 135 kv. over the chest and 200 kv. over the other portals, according to the "saturation technic," being careful not to exceed a full

erythema dose at any time. He aims to deliver from 1,800 to 2,400 r into all the portals, counting both the pre- and post-operative treatments.

Adair (1), in 1935, wrote in regard to the effect of pre-operative irradiation in primary operable cancer of the breast, as follows:

"Our study is based on 117 cases of operable mammary cancer. Each case had (1) positive biopsy; (2) pre-operative irradiation; (3) followed two or three months later by a radical mastectomy, and (4) careful tissue studies. Of this number, 65 cases were treated through five portals by the fractionated dose method, using the 200 kv. roentgen machine, giving 300 r daily to each of two portals. The portals used were one tangential to the breast medially, and one tangential to the breast laterally, thus cross-firing the breast lesion from two directions. The axilla was cross-fired through three ports: (a) axilla and supraclavicular anteriorly, (b) axilla direct, and (c) supraclavicular posteriorly.

"Of the 18 cases treated by roentgen radiation, giving 1,800 r per portal, there was not one instance in which the tumor remained the same size as originally described. Of these 18 cases clinically examined, there was reduction in size or disappearance of the tumor in all cases.

"Of the 36 cases treated by giving 1,200 r per portal, 43 per cent had complete clinical disappearance of axillary nodes. In contrast to this, 18 cases were treated giving 1,800 r per portal. With this treatment, 55 per cent had complete clinical disappearance of the nodes.

"Of the 36 cases treated by 1,200 r per portal, 19 per cent had complete microscopic disappearance of the breast cancer; not clinical disappearance as discussed above. When the dose was increased to 1,800 r per portal (600 r more per portal), the complete microscopic disappearance nearly doubled, namely, 33.3 per cent. In a similar way, the radiation effects went from 14 to 28 per cent. Of the total 65 cases treated by roentgen radiation, in 14, or 21.5 per cent, the tumor disappeared completely from the breast."

From these results we conclude that less than 1,800 r to a portal is insufficient dosage.

Adair, Frazell, and Quimby (2), in 1938, report on another series: "Of the 58 cases receiving x-ray therapy, 57 per cent of the tumors clinically disappeared if they received more than 4 T.E.D.

(threshold erythema dose = 500 r in air), while only 34 per cent of the tumors clinically disappeared if less than 4 T.E.D. were given. Doses in excess of 6 T.E.D. are desirable." These figures refer to tumor dose.

The time interval between completion of treatment and operation varied from six to 416 days. Time consumed in giving the treatments was on an average 21 days. These authors state further that the clinical and microscopical findings run closely parallel.

Another problem confronting the radiologist is, shall we attempt the radical irradiation treatment of cancer without surgery in those cases in which the disease is clinically confined to the breast? Considerable work has been done along this line, but the consensus of opinion at the present time is that the radical surgical operation is the method of choice, if the disease is clinically confined to the breast. If irradiation alone is to be relied upon, it must be thorough and complete.

Irradiation Alone.—Keynes (7) has had the most favorable results treating with radium, and his technic, or a modification of it, is generally used in cases in which radium alone is used. He has had 53 per cent of three-year cures.

Roentgen-ray treatment alone has not resulted in any favorable percentage of cures and has not equaled the results in which surgery is combined with irradiation. The improvement in technic and the larger doses over a longer period of time, as are in use to-day, will undoubtedly give higher percentages of five-year cures. Radium combined with x-ray has given better results in cases in which the x-ray treatments have been given before or after the use of radium.

Radiation Therapy Combined with Surgery.—It is generally conceded by surgeons to-day that some form of irradiation should be used in conjunction with surgery, although they do not all agree as to the value of pre-operative radiation.

Webster (11) says: "I am strongly in favor of pre-operative x-ray treatment.

It would seem obvious that a treatment which can cure a considerable proportion of recurrences should help to sterilize the whole field of operation, when it has been given from two to four weeks before operation and the percentage of recurrences should be lessened."

He also states: "As in no given patient can one be sure that operation will not be, or has not been, incomplete, the ideal, where operation is projected, would appear to be association of operation with pre- and post-operative x-ray courses of treatment."

Behan (3) states that the Radiumhemmet of Stockholm found that, in the cases which were irradiated pre-operatively, recurrences were less frequent, and occurred later than in the non-irradiated cases. It is certainly logical, and often the growth regresses during treatment.

The time the patient is operated upon after the x-ray treatment varies with the different surgeons. It can be done in a few days after treatment, or later when the erythema has subsided.

Post-operative Radiation.—For years radiologists were forced to use extensive arguments as to the value of post-operative radiation. The frequency of recurrences after operation, and the results obtained in the treatment of recurrences with roentgen therapy have convinced most clear-thinking surgeons of its value. It is not necessary to advocate its use before a group of radiologists.

In the absence of pre-operative radiation, post-operative radiation should be given as soon as possible, probably in a week. It does not interfere with the healing of the wound. It should be thorough and complete, following the divided dose method, and repeated in from six weeks to two months. As large a dose as can be delivered without injuring the tissues should be given at each treatment. Further irradiation should be given if there are recurrences or metastases.

Treatment of Recurrences and Metastases.—If there have been no previous x-ray treatments, a thorough treatment by

some type of the divided dose method should be given, covering the entire chest, front and back, the axilla, and the supra-clavicular area on the side involved. If the lungs or liver are involved, it is doubtful if any result will be obtained. In many cases there is an extensive skeletal metastasis without visceral involvement. A persistently painful back should be treated for metastases even if none is seen in the x-ray film, as they undoubtedly occur before they can be shown by the x-ray. Treatment of bony metastases relieves the pain and may result in recalcification of the broken-down areas. We have always treated the axilla and the entire side of the chest involved, both front and back, including the mediastinum and dorsal vertebræ, both pre- and post-operatively if possible. We have never seen metastases occur in the dorsal vertebræ when treated as above.

Since the most frequent skeletal metastases are to the pelvis and lumbar vertebræ, it is logical to give a prophylactic treatment over these areas. We have had marked relief of symptoms, for a time at least, when treatments were given over the skull for cranial involvement.

Radium is of great value for the treatment of localized recurrences.

Castration by Irradiation.—Witherspoon (13) states: "Since 1920, Wintz has used roentgen irradiation of the ovaries as a routine treatment in cases of cancer of the breast. Kaplan, in 1927, recommended castration by irradiation in the treatment of inoperable cancer of the breast, and recently Hoffman observed the disappearance of metastases to the scalp from carcinoma of the breast after roentgen irradiation of the ovaries."

Others have also reported on the favorable results of regression of the metastases from cancer of the breast when the ovaries are irradiated. Castration by radiation during the menstrual life of the patient is certainly logical and is rapidly coming into use, especially in younger women with cancer of the breast. We always try to obtain the patient's consent to treat the ovaries.

Treatment of Inoperable Carcinoma of the Breast.—Carcinoma of the breast should be classified as inoperable when there is a large ulcerating mass in the breast with adherence to the chest wall, or adherent nodules in the axilla with supraclavicular involvement. Films should be taken of the lungs, pelvis, and spine for possible metastases.

Irradiation in some form is indicated in treatment of inoperable cancer. This may cause a shrinkage of the tumor mass so that an operation can be done later, or it may be only palliative. Divided doses of roentgen rays should be given not only over the chest, axilla, and supraclavicular regions, but also to any skeletal metastases. The x-ray treatment will usually relieve the intense pain in the bones and may result in recalcification of the metastatic areas.

These treatments should be given with the 200 kv. technic over a period of three weeks, and repeated in from six to eight weeks if the patient's condition justifies further treatment. We give the treatments even though the patient is markedly cachectic, unless there are metastases to the lungs and abdominal viscera.

Complications of Irradiation.—Dangers of x-ray treatment through the lungs are a pleuropulmonitis and a fibrosis. Downs (5), in a review of 70 necropsies, describes two distinct reactions, as follows:

"1. A pleuropulmonitis, an edematous reaction, which is transient, usually disappearing within a year, if the lungs are otherwise normal.

"2. A fibrosis, which is permanent but rarely occurs unless the lungs are previously made vulnerable by metastasis, chronic disease, or infection."

He also states: "In only one case did we find a fibrosis which we believed to be attributable directly to irradiation."

In spite of Dr. Downs' findings, we think there is a real danger of fibrosis in heavy radiation of the lungs, but believe it is a chance which must be taken.

The acute symptoms due to a pulmonitis clear up in a few months, but some show

elevation of the diaphragm and a displacement of the mediastinum toward the treated side which is permanent. We have found that short wave diathermia relieves the acute symptoms promptly.

We have analyzed the results obtained by us since 1926, in the treatment of cancer of the breast. Some of the cases were given pre-operative as well as post-operative x-ray treatments, some were treated for recurrences after operation, and others were inoperable when first seen. Of the patients treated between 1926 and 1931, we have approximately 45 per cent with proven carcinoma of the breast living and well, from seven to twelve years after treatment.

Our method of treatment has changed since 1926, as we are giving larger doses of x-rays in divided doses and repeat the treatments whenever we feel it is necessary. We may cause some damage to the skin and underlying tissues, but feel that the prolongation of the patient's life justifies radical irradiation if there are recurrences or if the disease is inoperable.

We use the following technic: 200 kv. (constant potential), 5 ma., 50 cm. distance, and 1 mm. Cu plus 1 mm. Al for filter. The area to be treated is divided into four or five portals as follows: the first two cover the chest wall anteriorly and posteriorly, including the mediastinum, the lung, and axilla; the third portal through the axilla obliquely; the fourth portal, the supraclavicular region, to one inch below the clavicle. If the patient cannot abduct the arm, we treat through the axilla posteriorly.

One series of treatments is given in from 18 to 20 days in divided doses, alternating the portals. A minimum of 1,200 r is given to each of the portals except the axilla, which receives 900 r. This is in addition to the dose it receives from the first two portals. If the patient has not received a pre-operative treatment, we begin the series within a week after operation if possible, and repeat the same amount in six weeks after the first series is finished. If no involvement was found in the axilla, there

is usually no necessity for further treatments unless we find recurrences when the patient returns for inspection.

If there has been clinical or microscopical involvement in the axilla, a third treatment is given in from eight to twelve weeks later, using the tangential method over the chest wall, and another full treatment in the next six or seven months. We aim to give as much irradiation as the tissues can safely stand in the first year or 18 months. We treat any recurrences thereafter, varying the dose and the portal with the individual patient.

The patient is asked to return for inspection every three or four months, in cases in which there has been axillary involvement, for two years after the operation, as recurrences respond more readily to irradiation if they are discovered early. We have found less recurrences when the patient received both pre- and post-operative treatments.

To illustrate what persistence can do in the treatment of carcinoma of the breast, three cases are cited.

Case 1. A widow, 33 years of age, with no children. Previous history negative except that she had noticed her breasts became very painful and lumpy during her menstrual periods. For about a year before she came for examination, the right breast did not return to normal after menstruation but grew larger. We first saw her in October, 1928, when she had a large tumor in the right breast, which the patient said had been growing very rapidly. She had palpable axillary nodes. A surgeon had examined her, but she refused an operation.

We gave approximately 400 r to the tumor mass, but she refused to take any more treatment because of radiation sickness. She finally submitted to a radical mastectomy in February, 1929. The pathologist's report was adenocarcinoma, very malignant.

This patient returned for treatment in May, 1929, with recurrences in the axilla and supraclavicular region. In one month's time she was given approximately 1,800 r

each through the chest and mediastinum, both anteriorly and posteriorly, and to the supraclavicular region. We could not control her radiation sickness, and she refused to return in six weeks.

We did not see her again until the following year, 1930, when she had an ulcerating adherent mass in the axilla, edema of the upper chest wall and supraclavicular region, with involvement both above and below the clavicle. She was cachectic, had lost a great deal of weight, and was very short of breath. She appeared to be in the terminal stage, and we refused to give her any further treatment. Her family as well as the patient herself wished to try further irradiation.

She was given three series of x-ray treatments during 1930. The axilla was treated posteriorly as the patient could not abduct her arm. She received three more series during 1931 and 1932, a total of six series in two years. Much to our surprise, the recurrences disappeared and she gained 14 pounds in weight. She had no metastases to the lungs or skeletal system. A castration dose was given to the ovaries in 1931.

The patient seemed free from the disease during 1933, 1934, and 1935, and no further treatments were given during these years.

In the latter part of 1936, the upper portion of the scar showed an ulcerating area about 2 cm. in diameter, and there were scattered nodules adjacent to the scar. She was given about 300 r to these areas every three months. The nodules disappeared but the ulcerated area would not heal.

In September, 1937, while hanging a picture, three ribs on the right side suddenly fractured. We believe this was due to necrosis of the ribs from too much x-ray as there were no metastatic areas in any other bones. In October, 1937, the patient began to show metastases to the liver and other abdominal organs. She died in December—eight years and ten months after the operation.

This patient received a total of 14,000 r to the front of the chest, and 5,000 r to the chest posteriorly. The supraclavicular re-

gion received a total of 8,500 r, the axilla 4,500 r, in addition to the amount received from the anterior and posterior chest por-

This patient returned early in 1933, at which time 1,300 r over the anterior chest portal and 1,000 r to the axilla were given,



Fig. 1. Case 3. Secondary involvement of the third lumbar vertebra before treatment.

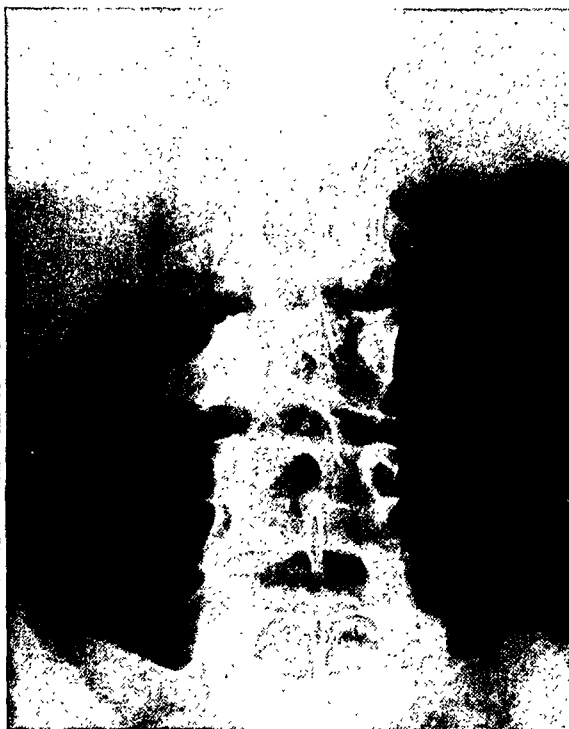


Fig. 2. Case 3. The same vertebra after treatment, showing complete recalcification.

tals. It was interesting to note that this case had no skeletal metastases which may have been due partly to the sterilizing dose given to the ovaries. No metastases occurred in the lungs.

Case 2. A woman, 41 years of age, whose previous history was negative. A lump appeared in the right breast following an injury in 1931. The lump was removed, but no section taken. Eight months later, another lump appeared in the same breast, at which time a radical operation was done. The diagnosis was adenocarcinoma, plus 2 or 3. She was referred for treatment several months later (in September, 1932) with recurrent nodules in the axilla. She was given two series of treatments, six weeks apart, over the chest front and back, supraclavicular region and axilla. She was given divided doses of x-ray, each portal receiving 1,740 r during each series.

as the nodules had not disappeared. When she returned in six months, she had a marked fibrosis of the lung and no further treatment could be given over the chest. She was, however, given further treatments in the next three years through the axilla and the upper portion of the scar, as these areas were very resistant to radiation. She received a total of 4,780 r to the front of the chest, 3,480 r to the supraclavicular region and back of chest in six months' time, and 10,000 r to the axilla and upper portion of the scar during the five years.

We examined her in June of this year. There were no recurrences or metastases present; the patient felt well and had gained weight. She can do her own housework but is short of breath on exertion. The fibrosis is not as marked, but the heart and mediastinum are held over to the right, and the right leaf of the diaphragm is ele-

vated. She appears to be well six years after treatment.

Case 3. This patient is under treatment

edly cachectic. Upon examination, we found the nipple of the right breast drawn upward and outward, an ulcerating mass



Fig. 3. Case 3. Shows a secondary malignancy of the ilium and head of femur.



Fig. 4. Case 3. Shows the same area after treatment with complete recalcification.

at the present time. She is a widow, 48 years of age, and the mother of one child. This patient states that she had noticed a small lump, just external to the right breast, in 1927. The nipple was retracted and she could feel small lumps in the axilla. The breast began to get hard and she could feel a string of glands along the anterior axillary border. She went to a layman, who applied "salve" over the entire breast area, in 1932, and again in 1933. This destroyed a great deal of tissue, but the ulcerating mass finally healed. She was referred to us for treatment in 1934.

At this time she was suffering intense pain in the lower back and left hip and ilium. She could not lift her legs, necessitating the use of crutches. She had to be lifted on and off the treatment table and was unable to turn herself. She had lost a great deal of weight and was mark-

over the right breast area (most of the breast tissue having been destroyed), and a large ulcerating mass in the axilla. Films were taken of the pelvis and back. Multiple metastases were found in the left hip and ilium, and a partial destruction of the third lumbar vertebra. There were no other skeletal metastases, nor any in the lungs.

She was given treatments over the pelvis and lumbar vertebrae which gradually relieved the pain. She also received a full series of x-rays over the chest wall, axilla and supraclavicular areas. The treatment over the pelvis stopped her menstruation. She was able to walk without crutches by April, 1935.

In order to protect her lung as much as possible, an area internal to a line from the nipple downward was given one-half

the irradiation that the area external to this line received.

Late in 1937, the patient complained of severe pain and a feeling of crunching in the cervical vertebræ. An x-ray film showed some changes in the lower four cervical vertebræ, but we could not say definitely that the changes were due to metastases, although there had been no such changes at our previous examination.

We irradiated the cervical vertebræ, and she wore a cast for nearly three months. She had no further pain or trouble in this area after the cast was removed. About a month ago, the patient had chains of small nodules running downward and inward from the nipple toward the sternum. This was the area that had received less irradiation than the area external to the nipple.

At the present time, there is a small tumor in the left breast just below the nipple, and this nipple is beginning to retract. We are now giving her treatments over the left breast. This patient has gained 25 pounds in weight, is able to walk without difficulty or pain, and is working for a living. The left hip, ilium, and third lumbar vertebra have recalcified and there are no other metastases shown.

The following dosage was applied to the different portals since she came under our care in 1934: entire pelvis, 2,800 r; left side of pelvis, 5,000 r; lumbar vertebræ, 2,000 r, and cervical vertebræ, 2,600 r. The right chest anteriorly, 4,000 r; posteriorly, 3,000 r. The supraclavicular area, 1,800 r, and the axilla through two portals, 2,550 r. An area external to the nipple on the anterior part of the chest received an additional 4,000 r.

It is interesting to note that no metastases occurred to the lungs or dorsal vertebræ in any of the three cases that were treated as above, nor have we found them in any of the cases that were given large doses of x-rays through the chest and lungs.

CONCLUSIONS

The only methods to-day for treatment of carcinoma of the breast are surgery, radium, and roentgen rays. The combi-

nation of these methods has more than doubled the percentage of five-year cures.

We believe that the attitude in cancer of the breast would not be so pessimistic if all cases were given both pre-operative and post-operative irradiation covering the mediastinum, lung, axillary and supraclavicular regions, and if a third series of treatments were given within another twelve weeks.

The patient should be inspected every three or four months for a period of two years after operation, and thereafter at least once or twice a year. Treatment should be given whenever it is necessary.

In cases in which no pre-operative irradiation has been given, the patient should be irradiated as soon after operation as possible, followed by two more series in from six to twelve weeks.

No patient should be considered to have received proper irradiation who has not had at least two series of treatments with a minimum of 1,800 r per series to the affected side, including the supraclavicular area with considerably more to the axilla. This applies especially to cases that have had clinical axillary involvement. A third series is advisable.

Persistent treatment of recurrences and skeletal metastases will often extend the life, usefulness, and comfort of the patient for many years.

A sterilizing dose of x-ray should be given to the ovaries in all young women who have cancer of the breast.

BIBLIOGRAPHY

- (1) ADAIR, FRANK E.: The Results of Treatment of Mammary Carcinoma. *Ann. Surg.*, 95, 410-424, March, 1932.
- (2) ADAIR, FRANK E., FRAZELL, E. L., and QUIMBY, EDITH H.: A Study of Tissue Dosage and Radiation Effect in Cases of Operable Cancer of the Breast Treated by a Combination of Pre-operative Irradiation and Radical Mastectomy. *RADIOLOGY*, 30, 588-597, May, 1938.
- (3) BEHAN, R. J.: *Cancer*. C. V. Mosby, 1938.
- (4) CRILE, G.: Analysis of 1,347 Cases of Malignant Tumors of the Breast, with Special Reference to Management and End-results. *Journal-Lancet*, 51, 99-102, Feb. 1, 1931.
- (5) DOWNS, ELWOOD EMERSON: Lung Changes Subsequent to Irradiation in Cancer of the Breast. *Am. Jour. Roentgenol. and Rad. Ther.*, 36, 61-64, July, 1936.

(6) HARRINGTON, STUART W.: Unilateral Carcinoma of the Breast Treated by Surgical Operation and Radiation. *Surg., Gynec. and Obst.*, 60, 499-504, February, 1935.

(7) KEYNES, G.: Radium Treatment of Carcinoma of the Breast. *British Jour. Surg.*, 19, 415-480, January, 1932.

(8) PFAHLER, GEORGE E.: The Treatment of Carcinoma of the Breast. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 1-18, January, 1938.

(9) PORTMANN, U. V.: A Comparison of the Results in a Series of Cases of Carcinoma of the Breast Treated by Post-operative Roentgen Therapy for Prophylaxis with a Similar Series in which Operation was

the Only Treatment. *Am. Jour. Cancer*, 27, 1-25, May, 1936.

(10) RICHARDS, G. E.: *Clinical Roentgen Therapy* (Pohle), pp. 161-193, 1938.

(11) WEBSTER, J. H. DOUGLAS: Cancer of the Breast: X-ray and Radium Treatment of Operable and Borderline Cases. *British Med. Jour.*, 2, 47-50, July 9, 1932.

(12) WHITE, WILLIAM C.: *Cancer of the Breast*, p. 24, Harper & Brothers, New York City, 1930.

(13) WITHERSPOON, J. THORNWELL: Roentgen Irradiation of the Ovaries as Supplement to Surgical and Radium Therapy for Mammary Cancer. *Arch. Surg.*, 33, 554-559, October, 1936.

PARAPLEGIA FROM EROSION OF VERTEBRAL COLUMN BY LARGE THORACIC ANEURYSM

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EROSION of vertebræ by thoracic and more particularly by abdominal aneurysms of the aorta is a rather frequent occurrence, but cases in which that erosion proceeds far enough to cause spinal cord symptoms by compression seem to have made a rather diminutive percentage of the total cases reported.

Recently the subject of cord compression in aneurysm has been dealt with by Ponde and Fialho (10) and by Fumarola (3). One hundred cases of aneurysm of the aorta were analyzed by Brindley and Schwab (15), who found 2 per cent of them in the descending thoracic aorta. Lucke and Rea (7) found five thoracic aneurysms in 263 cases of aortic aneurysm.

Putts and Bacon (11) point out that Vesalius, in the year 1555, recorded a case in which marked pain in the back had been the dominant feature, and which at autopsy disclosed a thoracic aneurysm with erosion of vertebræ.

The reason erosion so seldom goes to the point of actual exposure of the cord with compression would seem rather obvious: the aneurysm ruptures before such extensive bony destruction can take place.

Some of the largest aneurysms have relatively thin walls. Much depends, of course, upon the type and extent of thrombus formation within the aneurysm. Some aneurysms have a fibrous wall of such character that little upgrowth of granulation tissue into the mural thrombus appears, and the lower layers become quite compact (8). In such cases the wall of the sac may contain considerable amounts of calcium.

Thoracic aneurysms are ordinarily situated only a few centimeters above the diaphragm (5), and are rather definitely of the sacculated type (1). They are more frequent in men (4) with an age range of from 35 to 60 years. The dominant symptom is frequently pain, and in typical cases

spinal rigidity and obliteration of lumbar lordosis usually appear, with aggravation of pain on movement.

When erosion does progress to an advanced degree, the centers of the vertebræ are destroyed down to the spinal canal, leaving the yielding intervertebral disks standing (8): further destruction will involve the disks, but this is less frequent than bony destruction alone.

The lack of gibbus formation in so many cases has led to considerable discussion (9). Schanz (14) points out that gibbosity is in many cases doubtless prevented by the resistance of the aneurysm itself against the spine.

Cases have been reported with a duration of seven years (12); however, Reifenstein and Allen quote Cabot (*ibid.*) to the effect that most cases terminate within two years from the time that symptoms become definite.

Diagnosis of thoracic aneurysm is apt to be rather elusive, unless the physician is led to it by the complaint of intractable pain in the back, in which case the roentgenogram makes the state of affairs plain. Aneurysms in all portions of the aorta, for that matter, are more apt to come to correct diagnosis through some routine roentgenogram than in any other manner (6).

In the case to be described, the patient, E. D., a colored female, 47 years of age, married, gave a definite history of syphilis. She stated that she had had several Wassermann tests made, and that the first had been "two plus" but that succeeding tests had been "negative."

Her symptoms dated back to January of 1936. At that time she began to complain of pain in both legs, followed by weakness. By April of 1936, she had become unable to walk. Then followed a period of remissions and exacerbations of the symptoms relating to her legs. She regained the power to walk after a few

months, lost it again, and twice more regained and lost it. She became bedfast a few months before her admission to Cook

lower extremities: the right leg showed a flaccid paralysis, and the left a spastic one; there was, in other words, a complete

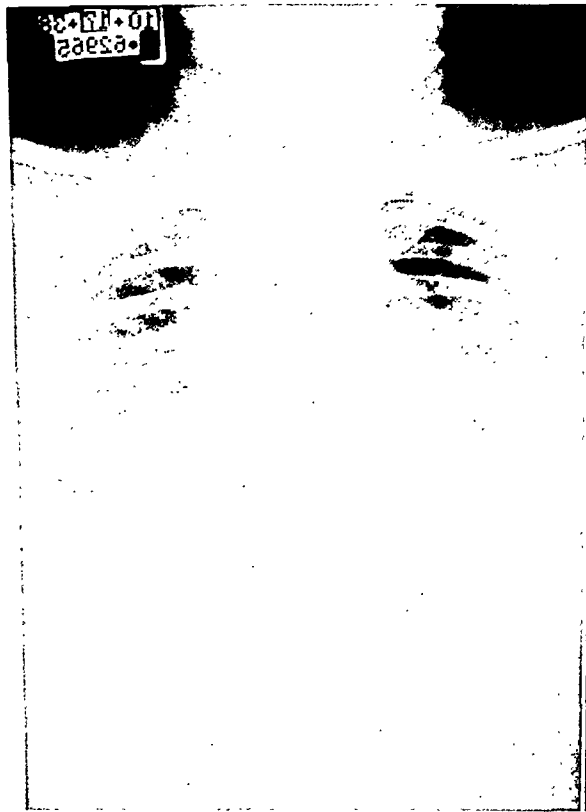


Fig. 1. Postero-anterior chest.



Fig. 2. Anteroposterior projection of dorsal spine.

County Hospital, which was in October, 1938.

There, on a neurologic service, the history taken revealed nothing of any consequence, in addition to the points just enumerated, except gradually increasing dyspnea.

The general physical examination revealed a blood pressure of 262/170, with considerable left-sided increase in the heart's diameter.

Neurological examination revealed the following: the tendinous reflexes in the upper part of the body, including both upper extremities, were essentially normal, and the cranial nerves showed no abnormalities aside from the finding of an Argyll Robertson pupil.

The pathologic findings were, in the

paraplegia—this being determined to be from the level of D6 with a complete sensory loss from the same level. While in the ward the patient complained of dyspnea, worse when she was constipated, and relieved by enemas.

The blood Wassermann was negative. The spinal Wassermann was four plus, with other findings as follows: xanthochromatosis; globulin present by Pandy test, three plus; pressure (base, 30; on straining, 40; right jugular, 38; left jugular, 35; both jugulars, 38); cells (50 lymphocytes, 200 red blood cells).

Despite the positive spinal fluid serology, the level of sensory and motor loss was so sharp that a tentative diagnosis of spinal cord tumor was made, and routine

roentgenograms of the chest and dorsal spine were ordered.

It was noted that the patient had not complained of pain in the back. Any pain mentioned had been referred to the lower extremities.

The chest roentgenogram revealed some distortion of a large heart shadow: there was a second outline superimposed, but not with such distinctness as to warrant the expression of an opinion.

The anteroposterior and lateral views of the dorsal spine revealed a large saccular out-pouching of the descending thoracic aorta, bordered by a thick rim of calcific density, resting upon the bodies of thoracic vertebræ four to eight, and having deeply eroded those vertebræ, especially the sixth and seventh. This finding seemed to offer much toward the diagnosis of cord compression.

Two days after the films were made, the patient experienced a sudden increase in the dyspnea of which she had previously complained. She sank rapidly, the blood pressure falling from 262 systolic to 140 systolic within a few hours, and she died the same day.

The autopsy findings relating to the subject of this paper are reproduced here *verbatim*, after the preliminary observation that the cause of death appeared to be cardiac failure and dilatation. There were no unusual findings in the brain and the aneurysm was not ruptured.

"Vertebral column: The anterior portions of the bodies of the fourth, fifth, sixth, seventh, and part of the eighth thoracic vertebræ are missing. The edges are eroded by the large, adherent aneurysmal sac, and on removing the sac the dura of the spinal cord is exposed in the region of the sixth and seventh thoracic vertebræ for a distance of 25 mm.

"The heart weighs 380 gm., the myocardium is firm, purple-red, the left ventricle measuring 20 mm., the right 4 mm.; the valves unchanged; pulmonary artery 81 mm., the aorta 80 mm. Just above the middle leaflet there is a 20 mm. path of longitudinal wrinkling. The intima of the

arch contains some hyaline plaques. The coronaries' walls are thickened and the intima contains many fatty plaques.



Fig. 3. Lateral projection.

"Aorta: Beginning from the first portion of the descending thoracic aorta the intima shows a fine wrinkling and contains numerous hyaline, fatty, and calcific plaques. Five centimeters below the arch the posterior wall presents a large defect 5 cm. in the vertical diameter and 3 cm. in transverse diameter. The defect extends into a large sac, 16 cm. in transverse diameter, 10 cm. in vertical diameter. The wall of the sac is partially calcified and fuses posteriorly with the vertebral column. The lumen of the sac is filled with laminated yellowish brown and reddish brown blood clots. On the anterior surface there are more recent purple-red blood clots."

SUMMARY

A case of aneurysm of the descending thoracic aorta is described, having the following unusual features:

1. Erosion of the thoracic vertebræ had proceeded to the point where the cord membranes were exposed for a distance of over 2 cm. and the resulting compression had produced a paraplegia from the level of the sixth dorsal vertebra.

2. Despite the extensive destruction of vertebræ, and in sharp contradistinction to most similar cases reported, the patient had never experienced pain in the back.

BIBLIOGRAPHY

(1) DELAFIELD, FRANCIS, and PRUDDEN, T. MITCHELL: A Text-book of Pathology, p. 660.

(2) FRANCOIS-DAINVILLE, E., and DONNEVE, R.: Massive Supra-diaphragmatic Ectasia of the Aorta. *Ann. d'anat. path.*, 13, 1137, 1138, December, 1936.

(3) FUMAROLA, G.: Compression of Spinal Cord from Aneurysm of Aorta. *Gazz. Internaz. med-chir.*, 39, 764-767, Dec. 15, 1931.

(4) GOLDTHWAIT, JOEL E., PAINTER, CHARLES F., and OSGOOD, ROBERT B.: Diseases of the Bones and Joints, pp. 597-601.

(5) HEKTOEN, LUDVIG, and RIESMAN, DAVID: An American Text-book of Pathology, pp. 540-542.

(6) KERLEY, P.: Two Unusual Aneurysms. *British Jour. Radiol.*, 8, 714-717, November, 1935.

(7) LUCKE, B., and REA, M. A.: Studies on Aneurysms: Aneurysms of Aorta. *Jour. Am. Med. Assn.*, 81, 1167-1170, Oct. 6, 1923.

(8) MACCALLUM, W. G.: Text-book of Pathology, pp. 718-723, fifth ed., 1932.

(9) MICHAELIS, L.: Question of Gibbosity from Aneurysm Leading to Erosion of Vertebræ. *Verhandl. d. deutsch. orthop. Gesell.* (1931), Kong. 26, pp. 277-280, 1932.

(10) PONDE, A., DE ARAUJO, E., and FIALHO, A.: Compression of Spinal Cord with Paraplegia Due to Syphilitic Aneurysm: Case. *Rev. Med. Latino-Am.*, 20, 475-493, February, 1935.

(11) PUTTS, B. S., and BACON, R. D.: Large Aneurysm of Descending Thoracic Aorta with Retrosoas Extension. *Am. Jour. Roentgenol. and Rad. Ther.*, 35, 59-64, January, 1936.

(12) REIFENSTEIN, E. C., and ALLEN, E. G.: Aneurysm of Thoracic Aorta: Case Presenting Some Unusual Features. *Am. Heart Jour.*, December, 1930.

(13) SCHOLZ, T., and KESSLER, E.: Importance in General Practice of Diagnosis of Aneurysm of Lower Descending Thoracic Aorta: Preliminary Report. *Med. Jour. and Rec.*, 137, 422-424, May 17, 1933.

(14) SCHANZ, A.: Aneurysm Wearing Away Spinal Column Prevents Gibbosity by its Own Resistance. *Archiv. f. Orthop.*, 28, 528-531, July 23, 1930.


(15) Quoted by Putts and Bacon, *q. v.*

THE PULMONARY ARTERY¹

A ROENTGENOGRAPHIC AND ROENTGEN KYMOGRAPHIC STUDY

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“ A rule, pulmonary artery disease is a postmortem finding, not diagnosed or diagnosable during life.” So states Paul D. White (1). In the light of our experience we cannot concur with this view unless the author refers to clinical and physical examinations alone. We believe with many roentgenologists that the x-ray method has advanced our knowledge of the lesser circulation and that a diagnosis of pulmonary artery disease can frequently be made during life. As a matter of fact, the lesser circulation is more accessible to investigation than the systemic, being entirely confined to the lungs, a region which is readily studied by the x-ray.

Our own interest in diseases of the pulmonary artery extends over a number of years, during which time we have accumulated a large collection of roentgenograms representing various lesions of the vessels of the lesser circulation. Some of the cases under our observation came to necropsy, thus enhancing the value of our material. More recently we have been able to use the roentgen kymographic method in the study of the heart and great vessels. The result of our observations is the basis of this paper.

Roentgen Anatomy of Pulmonary Conus and its Main Branches.—The anatomy of the pulmonary conus and its main branches is described by Cunningham (2) as follows: The conus or main trunk is about two inches in length and nearly one inch in diameter. It commences at the upper end of the infundibulum and runs backward and upward into the concavity of the aortic arch, where it bifurcates to form the right and left pulmonary arteries.

Roentgenologically the pulmonary trunk is a part of the great blood vessel shadow occupying approximately the left third of the shadow, the ascending aorta and vena cava superior, the middle and right thirds, respectively. In order to obtain a fairly accurate perspective of the conus and its branches the x-ray study includes all the four standard chest positions, namely, anterior, lateral, left and right obliques.

In the anterior position (Fig. 1-A) the left boundary of the conus is situated between the aortic knob and left auricular appendix. It varies in length, being longer in the vertical type of heart and shorter in the transverse, while its contour may be straight in the sthenic individual or slightly convex in the asthenic. In children the conus is usually more prominent. The right boundary of the conus cannot be differentiated from the adjoining structure, the ascending aorta, as the shadows are fused.

In the lateral position (Fig. 1-B) the conus is seen to extend upward and backward parallel to the aortic arch. Its anterior and upper boundary is clearly outlined, especially in cases of moderate pulmonary emphysema (as it is in this illustration). Its lower boundary cannot be distinguished from its origin, the right ventricle. At the termination of the conus there is a dense oval-shaped shadow due to the cross-section of the right pulmonary artery, indicating the bifurcation of the conus into its two main branches. The left pulmonary artery continues backward and downward before it enters the left lung. Below the left pulmonary artery a ring-like transparent shadow is often seen, due to the cross-section of a major bronchus.

The relationship existing between the

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trachea, bronchi, aortic arch, and pulmonary arteries is best shown in the following illustrations. In the anterior view (Fig. 2-A) the trachea lies to the right of the aortic arch, below which it bifurcates.

The right bronchus continues downward and slightly outward in a straight course. The left bronchus deviates to the left in its passage through the aortic loop. Between the aortic arch and left bronchus there is a



Fig. 1-A (upper left). Anterior view. Heart and aorta are normal. Pulmonary conus (P.C.) somewhat prominent. Lungs slightly emphysematous.

Fig. 1-B (upper right). Lateral view. Pulmonary conus (P.C.) distinctly outlined and denser than aortic arch (A.A.). Left pulmonary artery (L.P.A.) crossed by trachea (T).

Fig. 2-A (lower left). Anterior view. Tracheo-bronchial tree visualized by lipiodol injection. Bronchi rest upon left auricle. Left bronchus (L.B.) lies below right pulmonary artery (R.P.A.).

Fig. 2-B (lower right). Left anterior oblique view. Left bronchus (L.B.) lies within the aortic window (A.W.).

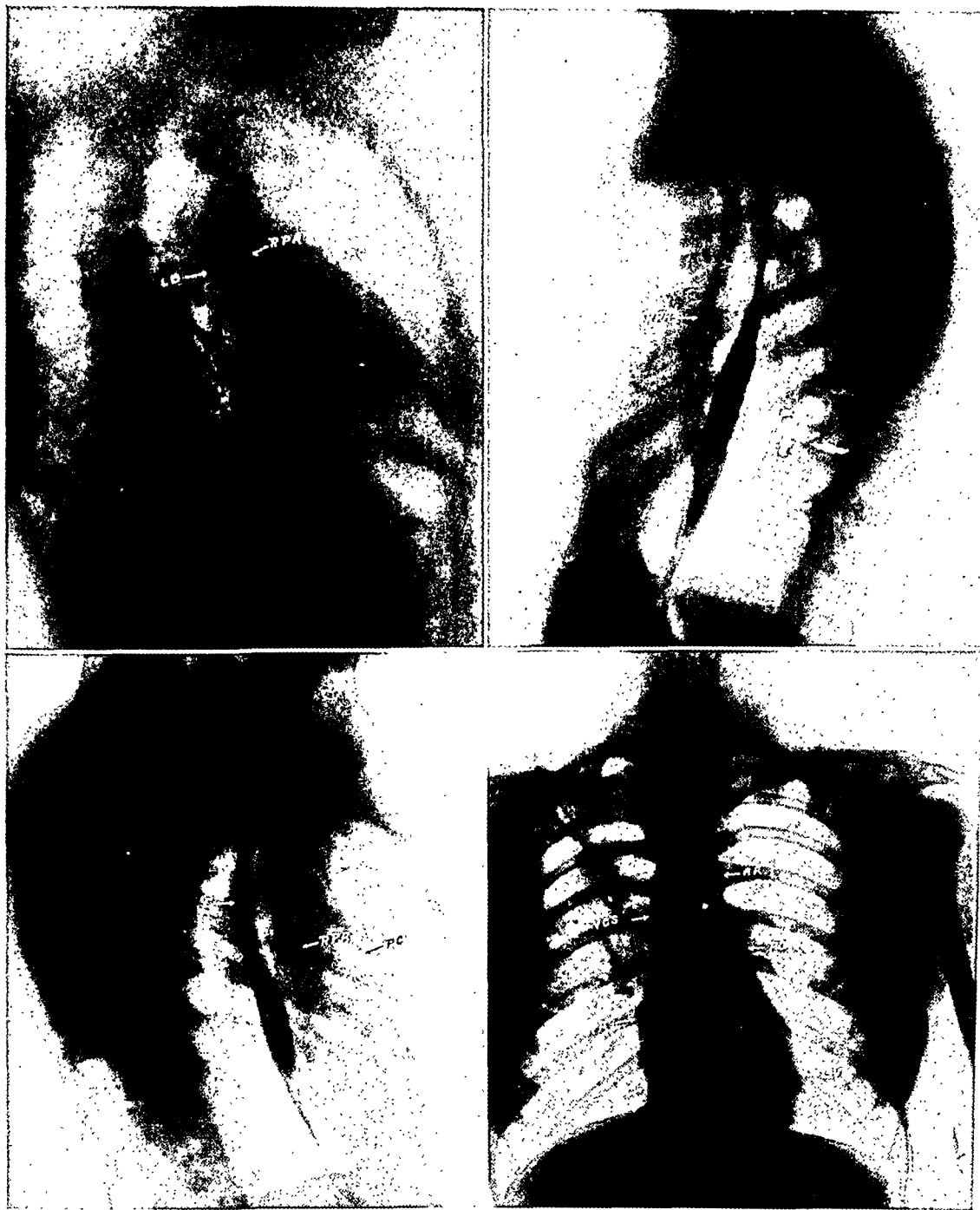


Fig. 2-C (*upper left*). Right anterior oblique view. Right pulmonary artery (R.P.A.) lies above left bronchus (L.B.). Pulmonary conus (P.C.) somewhat prominent. Impression upon trachea by the aortic arch (A.A.).

Fig. 3-A (*upper right*). Left anterior oblique view. Esophagus crosses the aortic arch behind trachea and right pulmonary artery (R.P.A.).

Fig. 3-B (*lower left*). Right anterior oblique view. Pulmonary conus (P.C.) somewhat prominent. Oval-shaped dense shadow due to cross-section of right pulmonary artery (R.P.A.). Aortic impression upon esophagus (E).

Fig. 4-A (*lower right*). Anterior view. Normal heart and great vessels. The several arcs are distinctly outlined. Aortic arch (A.A.), pulmonary conus (P.C.), left ventricle (L.V.), right auricle (R.A.), vena cava superior (V.C.S.), right ventricle (R.V.).

shadow of moderate density due to the right pulmonary artery. Both bronchi at their origin rest upon the upper surface of the left atrium.

In the left anterior oblique (Fig. 2-B) the aortic arch is readily outlined. Within the loop of the arch is the transparent aortic window which includes the lower end of the trachea and the origin of the major bronchi, especially the left one. The right pulmonary artery is in the anterior portion of the loop. In general, a diminution or complete obliteration of the aortic window follows dilatation of the left atrium and right pulmonary artery, such as often occurs in mitral lesions or in some types of congenital heart disease. Increase of the aortic window is usually found in aortic lesions with dilatation or elongation of the aorta. This fact may at times help to differentiate mitral from aortic lesions.

In the right anterior oblique (Fig. 2-C) the conus is usually projected toward the periphery of the vascular shadow on the left side. This is the most advantageous position in the study of the conus. The relationship existing between the right pulmonary artery and the left bronchus within the aortic loop is readily recognized. The impression of the aortic arch upon the left wall of the trachea is distinctly noted, a fact not usually recognized.

The relationship which exists between the aortic arch, trachea, pulmonary arteries, and the esophagus is shown in the illustrations which follow. In the anterior position the esophagus lies in front of the spine, crossing the aortic arch on its right side. In the left anterior oblique (Fig. 3-A) the esophagus crosses the aortic arch just behind the trachea. Below the arch it is in relation with the right pulmonary artery and right bronchus in front, and descending aorta behind. In the right anterior oblique (Fig. 3-B) the aortic impression upon the barium-filled esophagus is distinctly noted and just below it there is a slight impression produced by the right pulmonary artery.

From the above description it is evident

that the pulmonary conus, being in front, is in relation with the ascending aorta and aortic knob but bears no relation to the trachea, esophagus, or bronchi. The left pulmonary artery is in relation with the left bronchus, which lies below it but only after its exit from the aortic loop. The right pulmonary artery is in relation with the left bronchus and lesser curvature of the arch within the loop, and right bronchus and lower end of the trachea and esophagus outside the loop. Both bronchi rest upon the upper surface of the left atrium which constitutes the lower and anterior boundary of the aortic window.

With a knowledge of the relationship one can readily note the effect of one structure upon the other in the presence of enlargement or dilatation of an adjoining structure. Thus when the pulmonary conus is dilated it usually overlaps the ascending aorta and aortic knob. Enlargement of the right ventricle invariably displaces the conus upward and to the left, so frequently noted in mitral lesions and congenital heart disease. Dilatation of the left auricle displaces the conus forward and upward, also as noted in mitral lesions. Dilatation of the right pulmonary artery often obscures the aortic window, especially when accompanied by dilatation of the left atrium. In the presence of dilatation of the right pulmonary artery an impression upon the anterior wall of the esophagus is occasionally produced. The trachea and esophagus are often displaced backward as a result of dilatation of the left atrium and right pulmonary artery.

The blood vessels which originate from the pulmonary arteries divide and subdivide throughout the lung parenchyma, presenting a characteristic pattern upon the roentgenogram consisting of dense linear markings which gradually diminish in their caliber from the hilum toward the periphery of the lung. The vessels of the lung are highly distensible and their capacity alters with changes in intrathoracic pressure incident to the respiratory movements. In the presence of an impediment to the normal pulmonary circulation, di-

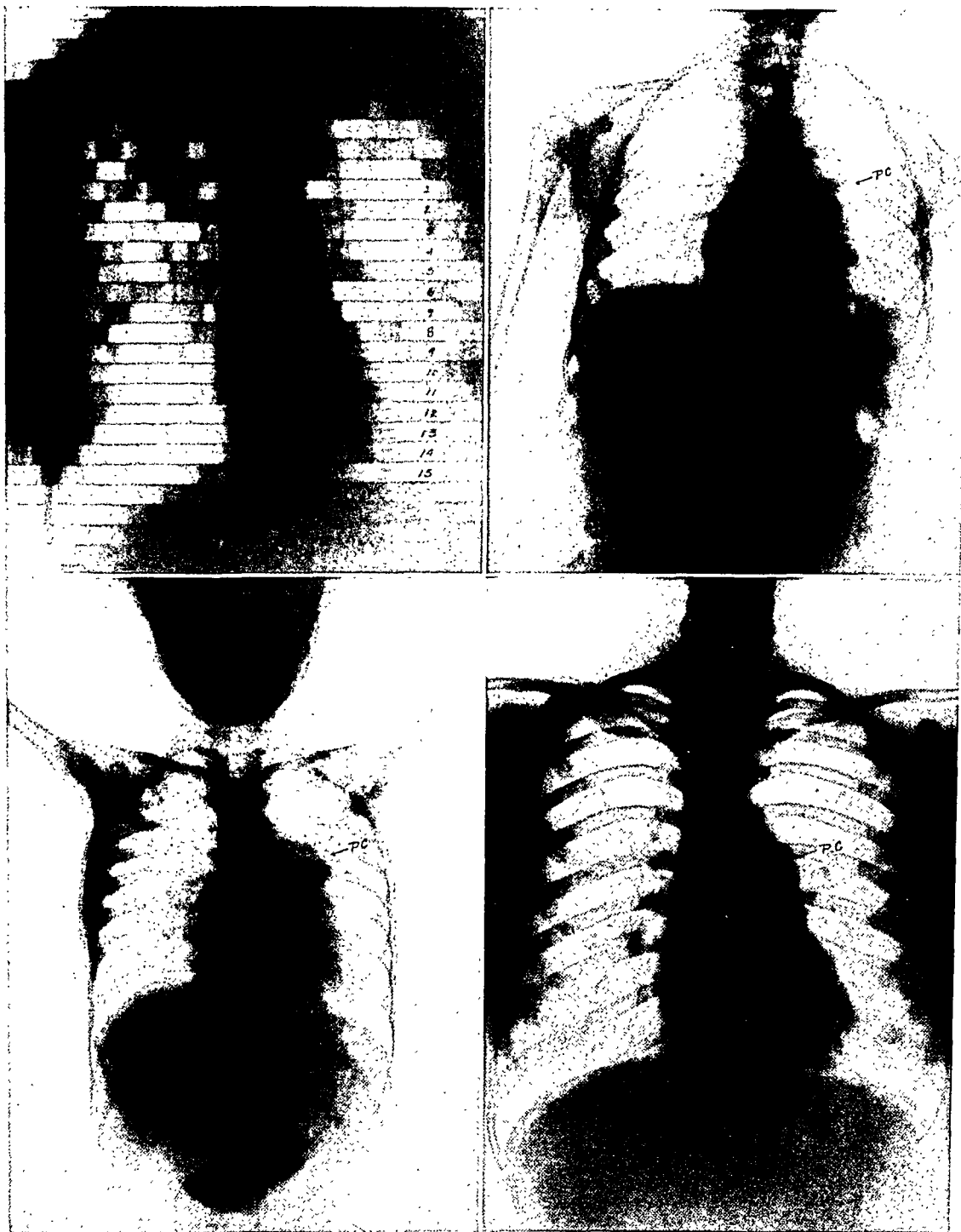


Fig. 4-B (*upper left*). Anterior roentgen kymogram. Left frames: 1-2 aortic waves, 4-5 pulmonary conus, 7 auricular, 9-15 left ventricular. Right frames: 1-8 vena cava superior, 9-11 right auricular, 12-15 right ventricular.

Fig. 5 (*upper right*). Anterior view. Pulmonary conus (P.C.) greatly dilated and overlaps the aortic arch in a case of open ductus arteriosus (congenital).

Fig. 6 (*lower left*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) quite prominent in a case of pulmonary stenosis (congenital).

Fig. 7-A (*lower right*). Anterior view. Pulmonary conus (P.C.) quite prominent in a case of possible open ductus arteriosus (congenital).

latation of the blood vessels will result, evidenced on the roentgenogram by accentuation of the blood vessel markings and decrease of the transparency of the lung-field.

Roentgen Physiology of the Pulmonary Artery.—The movements of the heart and great vessels are usually studied fluoroscopically. The pulsations of the auricles, ventricles, and large vessels and the force of the heartbeat are observed. As a rule, the pulsations of the ventricles are of greater force than those of the auricles. Those of the aorta and pulmonary artery are of about the same force but less than the ventricular. The fluoroscope enables one to obtain a fairly good idea as to the degree of the force, rhythm, and rate of the pulse. However, the method has its inherent limitations. At best it offers only a temporary visual impression subject to the prejudices of the observer. It is absolutely impossible to recognize the minute changes in the pulsations during diastole and systole as a result of physiological or pathological manifestations in the cardiovascular system. It is for the above reason that roentgenologists have for a long time searched for a method which would enable them to obtain permanent records of the visible motions of the heart and great blood vessels.

In 1911 Sabat (3), followed by Gott and Rosenthal (4) in 1912, was the first to introduce a method for recording the pulsations of the heart and great vessels. The technic was improved by Crane (5) in 1916, and perfected by Stumpf (6) in 1928. In this country Hirsch (7), Scott and Moore (8), and Johnson (9) have made outstanding contributions and are chiefly responsible for the great interest American roentgenologists have displayed in recent years in this field.

In brief, the principle and technic of this method, known under the name of "roentgen kymography," consist in the graphic registration on a photographic film of the movements of the heart and great vessels during systole and diastole. Such a record exhibits curves or waves along the

borders of the cardiovascular shadow varying more or less in form, depending upon their origin, *viz.*, auricles, ventricles, and vessels (Figs. 4-A and 4-B). The apices of the curves represent the diastolic phase, the troughs the systolic. The curves have certain common characteristics which consist of two limbs, an ascending diastolic and descending systolic, converging to form an acute angle at the periphery. The amplitude of the curves depends upon the force of the heartbeat, which determines the distance travelled between the diastolic and systolic phase. The ventricles exercising the greatest force, their waves are usually of greater amplitude than those of the auricles, whose force is limited, while those of the vessels are intermediary. The form of the wave is triangular, varying more or less in the degree of the angle depending upon the difference in the relative time duration of the systolic and diastolic phases. Since the systolic phase occupies less time than the diastolic, the triangles produced will vary from one which is at right-angles to the base (as in the vessels) to one which is acute (as in the ventricles). In all cases the diastolic angle is more acute than the systolic. The angles produced in the auricular waves are too minute to lend themselves to any kind of analysis.

In the presence of functional or organic changes in the heart, valves, or vessels there may occur alterations in the form and amplitude of the curves, a knowledge of which will enable one to arrive at a more accurate diagnosis than is possible on the plain roentgenogram alone or by the fluoroscope.

Diseases of the Pulmonary Arteries.—The pulmonary conus and its branches are subject to the same diseases as the aorta and its branches, although to a lesser degree and frequency. Among the most frequent congenital lesions of the pulmonary artery are patent ductus arteriosus and stenosis. They are usually characterized by dilatation of the pulmonary conus. An example of the former is illustrated in the case of J. K., aged 9 years (Fig. 5), whose film shows marked dilata-

tion of the pulmonary conus, which projects laterally and upward, obscuring entirely the aortic knob. The heart is not

enlarged. An example of the latter is that of R. V., aged 4 years (Fig. 6). The conus is quite dilated, with enlargement of the

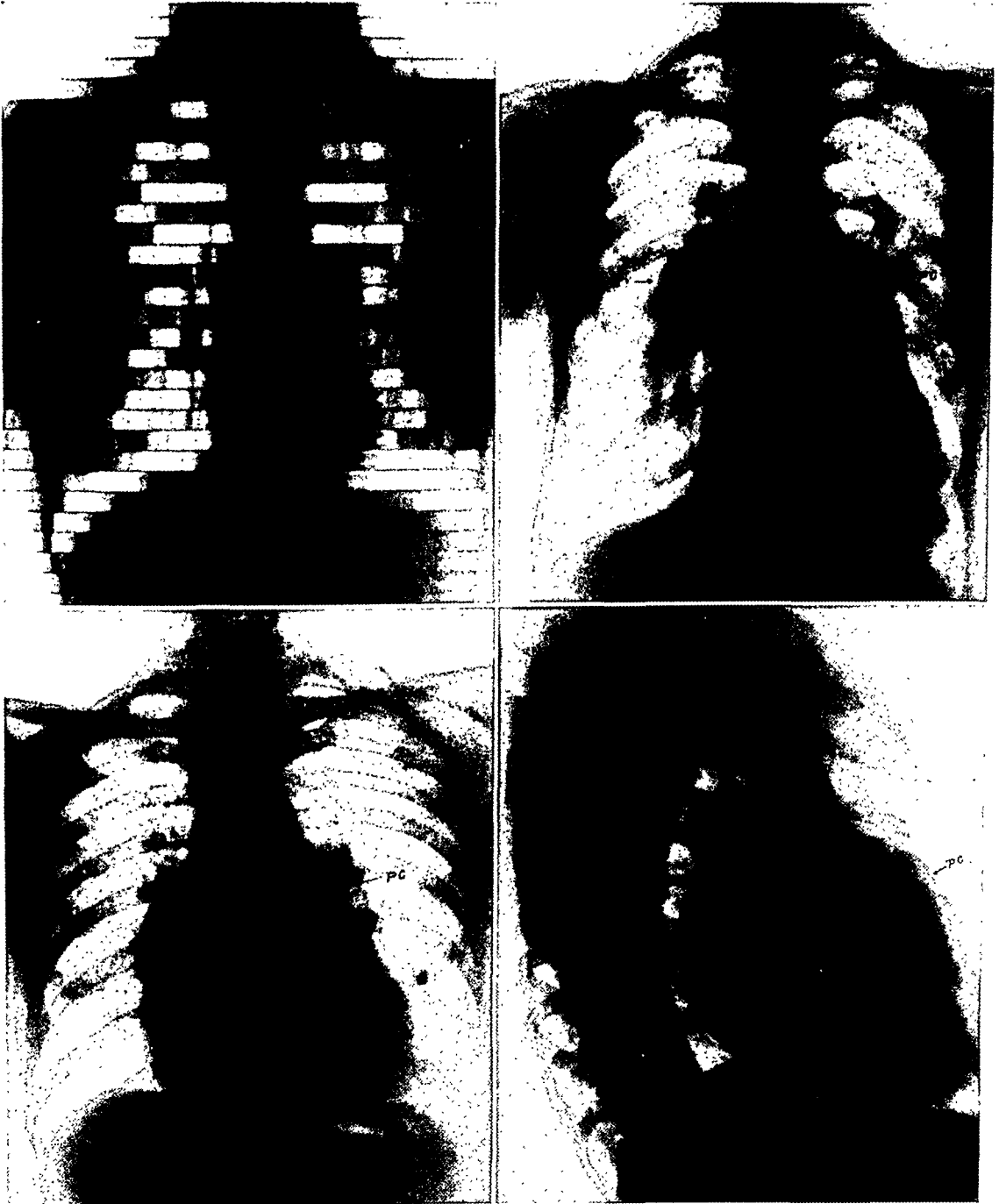


Fig. 7-B (*upper left*). Anterior roentgen kymogram. The waves of the pulmonary conus are quite prominent.

Fig. 8 (*upper right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) greatly dilated. Pulmonary vessels (P.V.) much distended in a case of intraventricular perforation (congenital).

Fig. 9-A (*lower left*). Anterior view. Heart is enlarged, especially right ventricle. Pulmonary conus (P.C.) prominent. Pulmonary vessels somewhat distended. Aortic arch normal in case of mitral lesion.

Fig. 9-B (*lower right*). Right anterior oblique view. Pulmonary conus (P.C.) very prominent. Esophagus is displaced backward by a dilated left auricle.

heart, especially to the right. The clinical and physical findings definitely confirmed the x-ray findings.

A case of dilated pulmonary conus but

without positive clinical and physical evidence of patent ductus arteriosus is presented by F. I., aged 14 years. In the anterior view (Fig. 7-A) the pulmonary

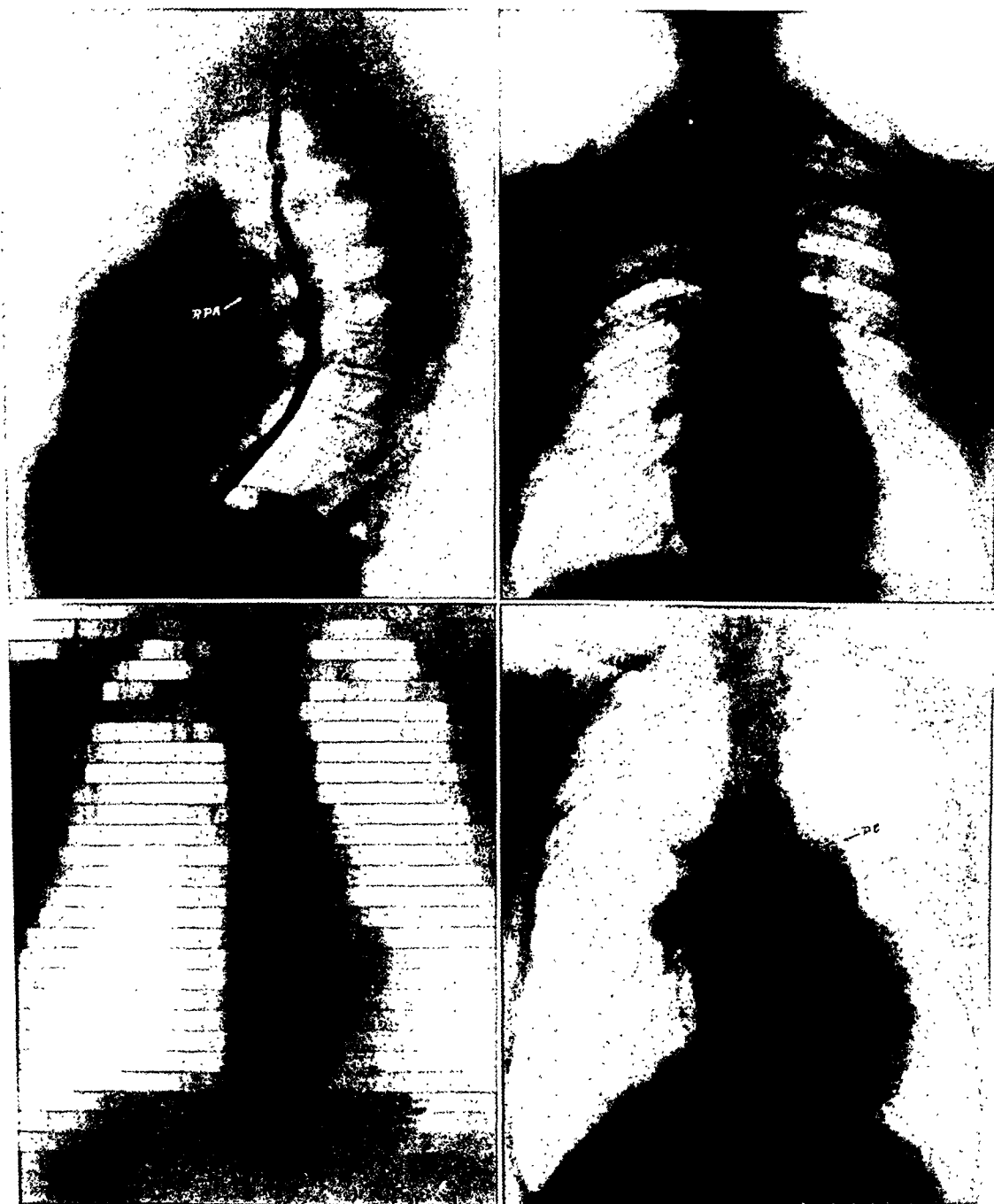


Fig. 9-C (*upper left*). Left anterior oblique view. The heart is globular in shape. Right ventricular border projects forward. Left auricular border displaces esophagus backward. The aortic window is obscured by dilatation of right pulmonary artery (R.P.A.).

Fig. 10-A (*upper right*). Anterior view. The configuration of the heart and vessels is of a typical mitral lesion.

Fig. 10-B (*lower left*). Anterior roentgen kymogram. The pulmonary conus waves are increased in amplitude.

Fig. 11-A (*lower right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) is prominent. Pulmonary vessels are distended.

conus is markedly dilated though the pulmonary arteries are not affected. The heart is of normal size and shape. In the roentgen kymogram (Fig. 7-B) the amplitude of the waves of the pulmonary conus is definitely increased, indicating increased force and possibly increased pulmonary hypertension.

The question as to whether or not increased amplitude of the waves of the pulmonary conus is indicative of pulmonary hypertension cannot be definitely answered. In systemic hypertension the amplitude of the waves of the aorta is not increased and at times even diminished. Why not apply the same rule in the case of the pulmonary artery? However, we have noted in cases of pulmonary emphysema, which are generally considered to have increased pulmonary hypertension, that the waves are of greater amplitude.

Intraventricular perforation with pulmonary stenosis is presented by the case of J. H., aged 32 years. The roentgenogram (Fig. 8) shows enlargement of the heart with considerable dilatation of the pulmonary conus. The pulmonary arteries are greatly distended. The diagnosis of congenital heart disease was made, although the physical findings tended to suggest an acquired lesion. On postmortem examination the intraventricular septum was found to be patent. The pulmonary conus, however, was not so much dilated as the roentgenogram had indicated. This suggests that the dilatation was of a dynamic origin existing only during life.

Among the acquired lesions mitral valvular disease is almost always accompanied by dilatation of the pulmonary conus and frequently also by dilatation of the pulmonary arteries and their branches.

The following case of a male, aged 52 years, is a typical example of mitral disease as revealed on roentgenograms taken in several positions. In the anterior view (Fig. 9-A) the heart is enlarged, especially to the right side. The cardiovascular notch is elevated on the right border, indicating enlargement of the right ventricle. The pulmonary conus is prominent.

The left auricular salient is bulging laterally, obliterating the so-called waist-line. The pulmonary arteries are somewhat dilated. The aorta is of hypoplastic caliber. In the right anterior oblique (Fig. 9-B) the prominence of the pulmonary conus is quite marked. The esophagus is displaced backward by the greatly distended left auricle. In the left anterior oblique (Fig. 9-C) the right ventricle is enlarged as shown by the forward projection of its anterior border. The lower end of the trachea, major bronchi, and esophagus are displaced backward due to dilatation of the right pulmonary artery and left auricle. The so-called aortic window is entirely obliterated as a result of the above-mentioned changes. The reverse takes place in aortic lesions in which the aortic window enlarges. This is due to the fact that the left auricle and right pulmonary artery are not dilated, that the dilated ascending aorta moves forward and to the right and the descending aorta to the left and backward, thus increasing the diameter of the aortic loop. Attention is also called to the backward displacement of the esophagus in mitral lesions which remains behind the heart shadow through its entire course in the left anterior oblique position, while in aortic lesions associated with left ventricular enlargement the esophagus crosses the left ventricle when viewed in the same position.

The roentgen kymographic findings in mitral lesions are illustrated by the case of A. P., aged 24 years. The anterior view (Fig. 10-A) presents the usual findings of an early mitral stenosis. The heart is moderately enlarged, especially to the right; the cardiovascular notch is elevated on the right border, indicating enlargement of the right ventricle. The pulmonary conus is only slightly prominent. The so-called waist-line on the left side is obliterated, while the aorta is not dilated. In the roentgen kymogram (Fig. 10-B) the amplitude of the aortic pulsations is within normal limits while that of the pulmonary conus is quite prominent and beyond the normal limits of physio-



Fig. 11-B (upper left). Lateral view. Pulmonary conus (P.C.) and pulmonary arteries (P.A.) are dilated and show an increase in density due to sclerosis of pulmonary artery.
 Fig. 12-A (upper right). Anterior view. Heart is small. Pulmonary conus only slightly prominent. Lungs are emphysematous.
 Fig. 12-B (lower left). Right anterior oblique view. Pulmonary conus (P.C.) is markedly dilated. Sclerosis of pulmonary artery confirmed by necropsy.
 Fig. 13-A (lower right). Anterior view. Heart is normal. Pulmonary conus (P.C.) slightly prominent.

logical variations. The amplitude of the waves of the left ventricle is normal, while that of the right is definitely enlarged. Such a finding is the usual one with a well-compensated heart. However, when the heart is greatly enlarged and has lost its tone the pulsations are of very small amplitude.

Arteriosclerosis of the pulmonary arteries is a frequent finding in pulmonary diseases such as emphysema, chronic bronchitis, chronic pleurisy, chronic pulmonary tuberculosis, congenital and acquired heart disease and idiopathic cases in which no definite cause is accountable for the sclerosis. Sclerosis may or may not be associated with dilatation of the pulmonary vessels, the former, however, being more frequent. In the aged, sclerosis of the arteries is often found without much dilatation of the vessels.

A good example illustrating a so-called idiopathic pulmonary sclerosis is that of Dr. H. S., aged 54 years, who for many years complained of symptoms referable to the chest but without definite physical findings except for moderate enlargement of the heart. In the anterior view (Fig. 11-A) the heart is somewhat enlarged. The pulmonary conus and arteries are dilated, the aorta being of normal caliber. In the lateral view (Fig. 11-B) the pulmonary conus and arteries are dilated and show great increase in density. It is evident that the lateral view is of considerable assistance in enabling one to obtain a more accurate knowledge of the condition than is possible by the anterior view alone, and this has been found to be the case in many other instances. The patient died suddenly but no necropsy was obtained. Since the lungs presented such minimal changes one might conclude that this case was a primary arteriosclerosis of the pulmonary artery.

An example of secondary arteriosclerosis of the pulmonary artery is illustrated by the following case of a man, aged 49 years. In the anterior view (Fig. 12-A) the lungs present marked emphysema. The apices show dense calcified deposits, evidence of

an old tuberculous infection. The diaphragm is very low and its excursions are almost absent. The heart is elongated and rather small. The pulmonary conus does not appear to be enlarged. In the right anterior oblique view (Fig. 12-B) the pulmonary conus is quite prominent and is of dense consistence. The diagnosis of arteriosclerosis of the pulmonary artery was confirmed by necropsy.

Attention has been called before to the direct relationship existing between the right pulmonary artery and the esophagus. Under normal conditions the barium-filled esophagus is not affected by the vessel as is the case with the aortic arch. In the presence of dilatation of the right pulmonary artery the esophagus may present an impression in its contour. This is well shown by the case of patient A. P. In the anterior view (Fig. 13-A) the heart and aorta are within normal limits. The pulmonary conus is somewhat prominent. In the right anterior oblique (Fig. 13-B) the pulmonary conus appears quite prominent. Opposite the conus on the posterior border there is a distinct impression upon the contour of the esophagus produced by the dilated right pulmonary artery. Above, there is another one, somewhat smaller, produced by the aortic arch.

The case of patient F. B. illustrates the roentgen kymographic findings of arteriosclerosis of the pulmonary artery. In the anterior view (Fig. 14-A) the heart shows moderate left ventricular enlargement and calcified plaques in the aortic wall. The pulmonary conus is quite prominent. The roentgen kymogram (Fig. 14-B) shows pulsations of great amplitude, especially in the regions of the pulmonary conus and right ventricle.

A case of peri-arteritis nodosa, the only one proven in our experience, is that of a male, S. C., aged 74 years. The anterior view (Fig. 15) presents marked enlargement of the heart and dilatation of the aorta and pulmonary conus. The pulmonary vessels are greatly dilated on both sides of the heart, especially marked on

the right side, and extend considerably into the lung-fields. On necropsy the condition was found to be due to peri-arteritis nodosa.

Aneurysms of the pulmonary conus are comparatively rare. When they are found

they must be differentiated from aneurysms of the aorta and mediastinal or lung tumors. An aneurysm of the pulmonary conus is illustrated by patient I. K., a white woman, aged 39 years. In the anterior view (Fig. 16-A) the heart is shown to be

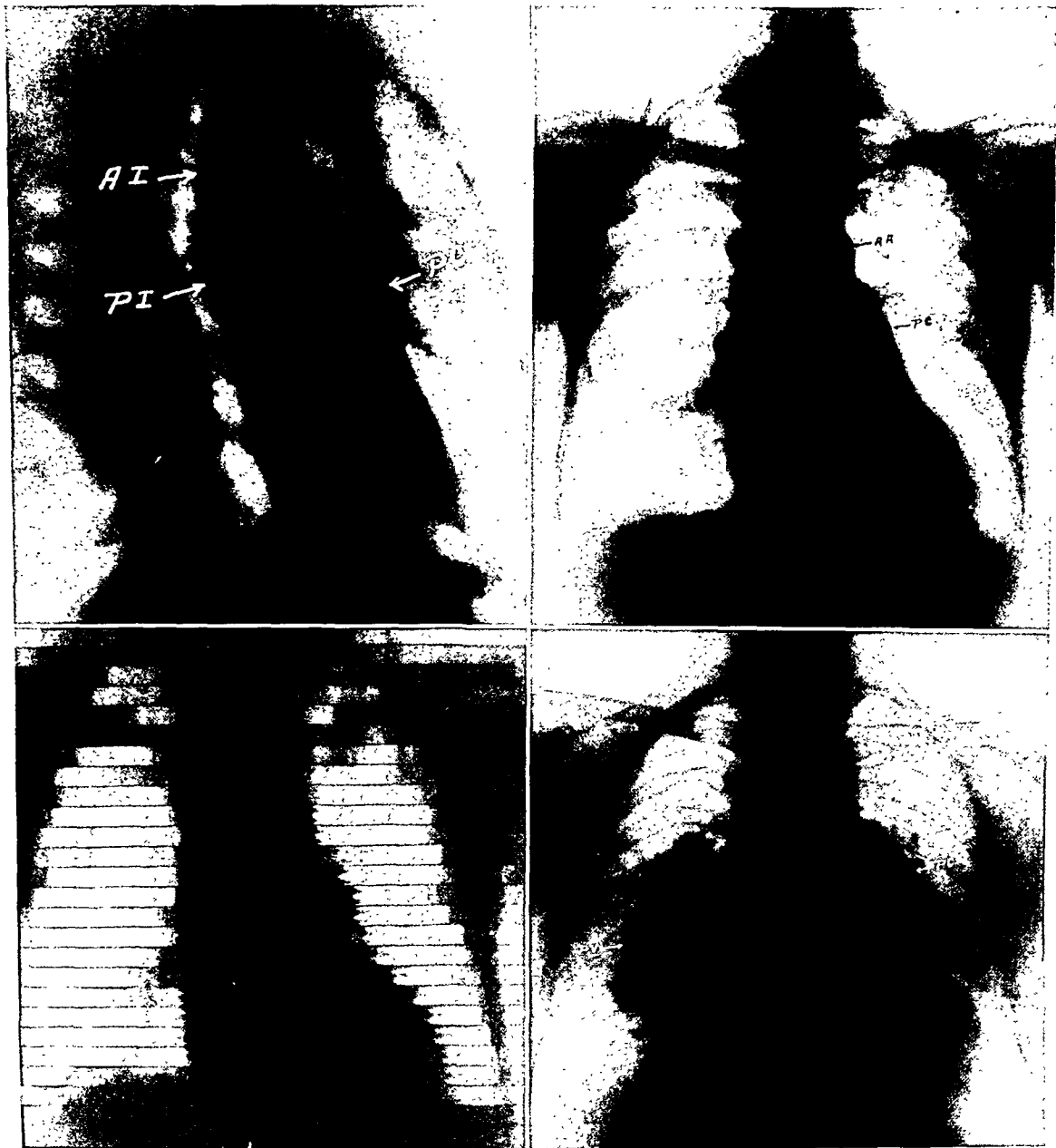


Fig. 13-B (*upper left*). Right anterior oblique view. Pulmonary conus (P.C.) quite prominent. Right pulmonary artery is dilated, producing a pulmonary impression (P.I.) upon esophagus. Above is the aortic impression (A.I.).

Fig. 14-A (*upper right*). Anterior view. Left ventricle is somewhat enlarged. Pulmonary conus (P.C.) is quite dilated. Calcified plaques in aortic arch (A.A.).

Fig. 14-B (*lower left*). Anterior roentgen kymogram. The waves of the pulmonary conus show an increase in amplitude.

Fig. 15 (*lower right*). Anterior view. Heart is enlarged. Pulmonary conus (P.C.) is greatly dilated. Pulmonary vessels (P.V.) markedly distended in a case of peri-arteritis nodosa, confirmed by necropsy.

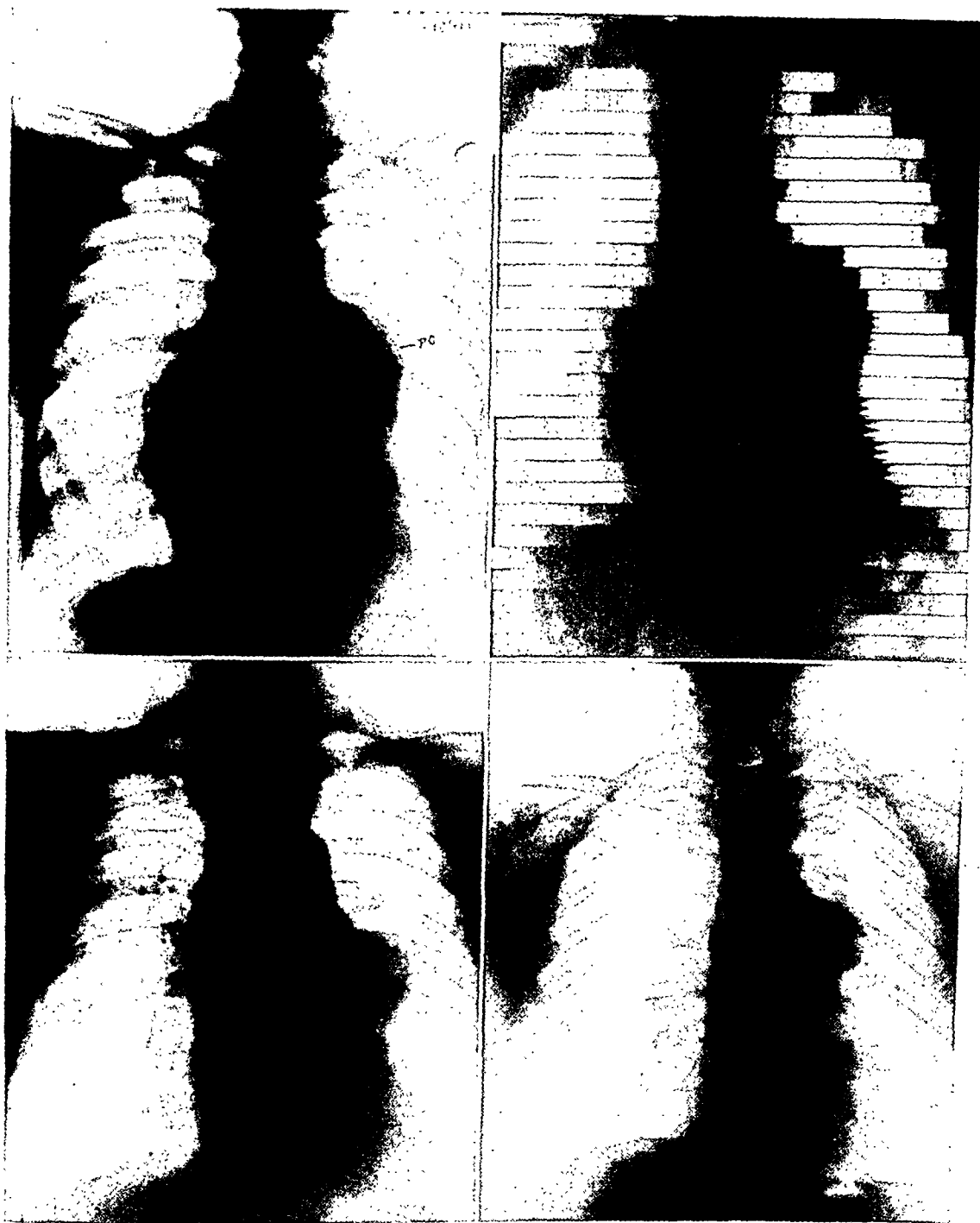


Fig. 16-A (*upper left*). Anterior view. Heart is enlarged, especially the right ventricle. The pulmonary conus (P.C.) is markedly dilated and overlaps aortic arch due to an aneurysm.

Fig. 16-B (*upper right*). Anterior roentgen kymogram. The amplitude of the waves of the pulmonary conus is diminished; however, the presence of waves proves it to be an aneurysm and not a tumor.

Fig. 17 (*lower left*). Anterior view. Heart shows enlargement of left ventricle. Aorta is dilated. In region of pulmonary conus there is a large bulging over (but not overlapping of) the aortic arch due to an aneurysm of the sinus of Valsalva.

Fig. 18 (*lower right*). Anterior view. Heart and vessels are normal. Large prominence in region of pulmonary conus overlapping aortic arch. Esophagus and trachea displaced to right, indicating the location of the shadow in posterior mediastinum; proven by the x-ray therapeutic test to be due to a pulmonary tumor.

enlarged to the right. The cardiovascular notch on the right border is elevated, indicating enlargement of the right ventricle: the left ventricle and aorta are within normal limits. In the region of the pulmonary conus there is a marked prominence which appears to originate from the vessel and partially overlaps the aortic arch. The roentgen kymogram (Fig. 16-B) shows pulsations of very low amplitude in the region of the expanded conus, indicating impairment of the vessel wall due to an aneurysmal dilatation and not to a mediastinal tumor.

Aneurysms arising from the sinus of Valsalva and projecting to the left are infrequent. When they do occur they offer some difficulty in differentiating them from aneurysms of the pulmonary conus, since they occupy the same region. There are, however, certain distinguishing characteristics, as illustrated by the following case of patient F. A., aged 47 years. In the anterior view (Fig. 17) the heart is enlarged to the left while the aorta is dilated. The cardiovascular notch on the right border is lowered, indicating elongation of the aorta. The prominence in the region of the pulmonary conus is on a lower level and does not overlap the aortic arch as occurs with dilatation of the pulmonary conus. In other words, this case has all the secondary changes which are usually found with an aortic aneurysm.

A mediastinal or lung tumor located in the region of the pulmonary conus may offer some difficulty in differentiation from an aneurysm. The case of M. R., aged 59 years, white, male, reveals in the anterior view (Fig. 18) a prominence in the region of the pulmonary conus. The heart and aorta are apparently normal. The trachea and barium-filled esophagus are somewhat displaced to the right. This fact indicates that the abnormal shadow is related to the posterior mediastinum and not to the pulmonary conus or ascending aorta, which are located anteriorly. The diagnosis of pulmonary tumor was confirmed by the therapeutic test as it completely disappeared under x-ray treatment.

CONCLUSION

The normal roentgenographic and roentgen kymographic appearance of the pulmonary conus and vessels and their relationship in various positions are described. Cases illustrating congenital and acquired lesions in which the pulmonary conus and vessels are involved are presented. The differential diagnosis between aneurysm of the pulmonary conus and aorta and mediastinal or lung tumors is discussed and illustrated.

REFERENCES

- (1) WHITE, PAUL D.: *Heart Disease*. The Macmillan Co., 1931.
- (2) Cunningham's *Manual of Practical Anatomy*. Oxford Medical Publications, Vol. 2.
- (3) SABAT, B.: Ueber ein Verfahren der röntgenographischen Darstellung der Bewegungen innerer Organe. *Fortsch. a. d. Geb. d. Röntgenstrahlen*, 20, 42, 1913.
- (4) GOTT, THEODOR, and ROSENTHAL, JOSEPH: Ueber ein Verfahren zur Darstellung der Hertzbeziehung Mittels Röntgenstrahlen (Röntgenkymographie). *Munchen. med. Wchnschr.*, 59, 2033-2035, September, 1912.
- (5) CRANE, A. W.: Roentgenology of the Heart. *Am. Jour. Roentgenol.*, 3, 513-524, 1916.
- (6) STUMPF, P.: Die Gestaltänderung des Schlagenden Hertzens im Röntgenbild. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 38, 1055-1067, December, 1928.
- (7) HIRSCH, I. SETH: The Recording of Cardiac Movements and Sounds by the Roentgen Ray. *RADIOLOGY*, 22, April, 1934, and 23, December, 1934.
- (8) SCOTT, WENDELL G., and MOORE, SHERWOOD: Roentgen Kymography in Diseases of the Heart. *Jour. Am. Med. Assn.*, 107, 1951-1954, Dec. 12, 1936.
- (9) JOHNSON, SIDNEY E.: Roentgen Kymography Considered in Relation to Heart Output and a New Heart Index. *Am. Jour. Roentgenol. and Rad. Ther.*, 37, February, 1937.

DISCUSSION

GEORGE LEVENE, M.D. (Boston): The paper presented by Dr. Brown treats of an important and rather neglected field of roentgen exploration. Disease of the pulmonary arteries themselves is common enough to require investigation. Moreover, changes are effected in the larger branches and vascular bed as a result of many varieties of pulmonary pathology. The lesser circulation is intimately associated with the heart so that changes occurring in one are in time reflected in the other.

Congenital lesions of the pulmonary artery are more commonly recognized because the changes are gross and rather

marked. Pulmonary stenosis, patent ductus arteriosus, and transposition of the great trunks all give rise to characteristic pictures. The formation of arterio-venous aneurysms in the hilar branches produces large, dense hilar shadows occasionally mistaken for enlarged nodes or neoplasms.

Dr. Brown has not stressed sufficiently the need for thorough fluoroscopic examination which, in our experience, is the most satisfactory means of localization and of differentiating orthoconous and transmitted pulsation.

While I agree with Dr. Brown and Dr. Hirsch and Dr. Scott about the general usefulness of the kymogram, I still would like to make a plea that you do not abandon fluoroscopic study. It brings you into intimate contact with your patient; you will have a chance to make your personal observations by seeing the organ in motion, and you are studying the phenomenon of motion. In our experience in a rather large heart clinic, we feel that fluoroscopy is absolutely indispensable.

For example, in patent ductus arteriosus blood may be shunted from the aorta to the pulmonary artery, or from the pulmonary artery to the aorta. In the former case, the ascending aorta shows increased pulsation and the descending aorta diminished pulsation, while in the pulmonary artery-to-aorta shunt the findings are reversed—there are diminished pulsations in the ascending aorta and increased pulsations in the descending aorta.

The importance of changes in the vascular bed in such common conditions as

mitral valvular disease may be emphasized. Increased pressure arising within the left auricle and transmitted backward into the lungs produces pulmonary congestion and so-called "brown induration." This frequently results in the production of râles and hemoptysis and is a common cause of the mistaken clinical diagnosis of pulmonary tuberculosis.

In reviewing a series of 100 cases of pulmonary asbestosis, it was interesting to note that the most constant change was enlargement of the primary branches of the pulmonary artery. The typical or pulmonale, probably resulting from increased resistance to the flow of blood into the lungs as a result of fibrosis, emphysema, or other change, is of course a lesion of the lesser circulation.

Our knowledge is still very incomplete concerning the roentgenologic aspects of pulmonary thrombosis, Ayerza's disease, and pulmonary hypertension. The work of Dr. Brown and his colleagues is important. Such investigations, supplemented by the procedures recently introduced by Robb and Steinberg for the visualization of the heart chambers and vessels, will in time disclose a wealth of hidden treasure.

SAMUEL BROWN, M.D. (*closing*): Dr. Levene calls attention to the fact that I have not sufficiently emphasized the use of the fluoroscope in my paper. I wish to state that practically every cardiovascular case receives a thorough fluoroscopic examination before any roentgenograms or roentgen kymograms are made.

CROSS-SECTIONAL RADIOGRAPHY OF THE HEART

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From the Roentgenological Department of the Mount Sinai Hospital

A ROENTGENOLOGIC visualization of the heart, in such a manner as to give a radiologic equivalent to its anatomical cross-section, has been an old problem in cardiac roentgenology.

rate manner, cuts cardboard silhouettes of many different heart diameters and in setting them together completes the heart model. Lysholm (3) designed an ingenious arrangement permitting direct cutting

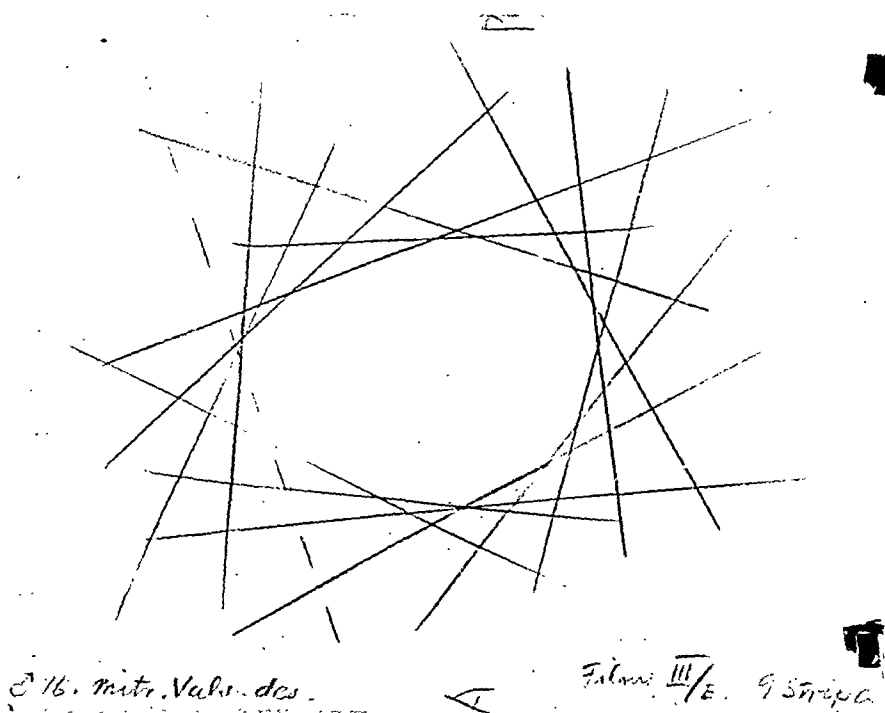


Fig. 1. Drawing of cross-sectional roentgenogram following the old method based on the 360-degree rotation of the patient. (From Szabados, *RADIOLOGY*, 27, 693, December, 1936.)

This problem has been approached repeatedly in the past. The several available solutions are, however, complicated, time-consuming, not very exact, and require additional expensive equipment. The underlying principle for all these methods is based on the 360° rotation of the patient around his vertical axis with the recording of the heart borders in different diameters. In this manner, the cross-section can be reconstructed. Some authors go beyond this and produce three-dimensional models of the heart. Palmieri (4), in a very elabo-

of a three-dimensional heart model from clay. A rotating chair for the patient is connected with a rotating stand for the clay and an exact correlation with their degree of rotation is maintained. A narrow beam around the central ray is moved under fluoroscopic control along the heart borders. A steel string, mechanically connected with the tube, automatically cuts through the clay so that an approximate model of the heart is fashioned after cutting several diameters. This method was later revived by Schatzki (5). Klason

(2) devised an attachment by which an electric rod mechanically follows the movements of the central ray controlled by the

cross-section radiography of the heart using a fundamentally different projection from those commonly accepted. This study is



Fig. 2. Lateral view of the thorax demonstrating the oblique orientation of the long axis of the heart (*D*) in relation to the longitudinal axis of the thorax.

fluoroscopist and produces strip-like exposures on photographic paper as desired. He thus obtains a number of lines which produce an approximate outline of a cross-section through the heart. A similar principle for drawing under fluoroscopy or indirectly, after exposing several film strips at different angles, was recently published in this country by Szabados (6). (See Fig. 1.)

All these methods, unfortunately, take considerable time, and any motion of the patient during the long examination greatly endangers the accuracy of the measurements. It is, furthermore, not possible to record fine details of the heart contour. Were a direct, instantaneous exposure of the cross-section of the heart possible, its superiority over the indirect methods described above would be apparent.

The purpose of this study is to present such a roentgenologic possibility for a direct

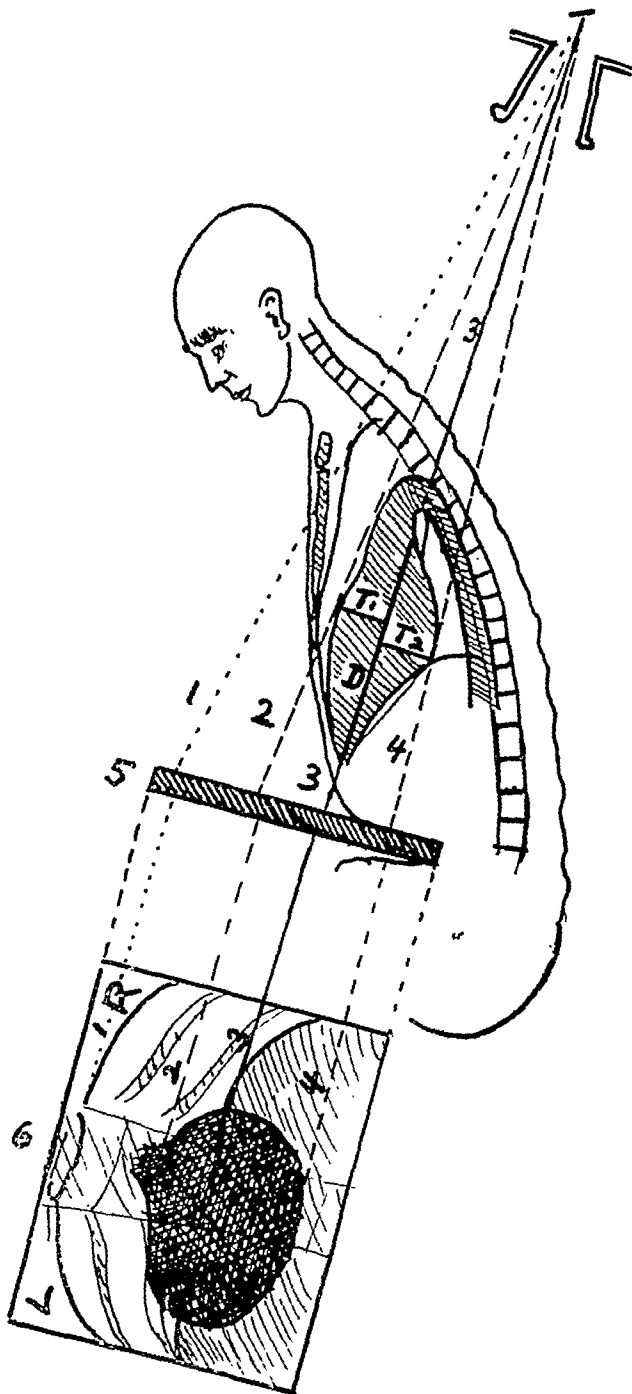


Fig. 3. Technic of cross-section roentgenography of the heart. The central ray (3) is directed along the long axis of the heart (*D*). The cassette (5) is placed deep into the cardiac groove perpendicular to the central ray (3). Lines 2 and 4 indicate the projection of the anterior and posterior heart border; line 1, the projection of the pulmonary apex; 6 is the diagram of the film.



Fig. 4. Direct cross-sectional roentgenogram of the heart with good visualization of the border between the right and left ventricles (arrow).

limited only to its theoretic principles and roentgen-technical factors. The roentgen-clinical aspects of this method will be summarized in a later study.

The principle underlying this technic is easily understood (Figs. 2 and 3). On examining a lateral view of the chest, we note that the long axis of the heart—its diagonal diameter—forms an angle averaging from 45 to 50 degrees with the longi-

tudinal diameter of the thorax. This angle is increased in obese and emphysematous patients and decreased in asthenic types. Making use of this oblique orientation of the heart within the thorax, a technic was developed as follows: first, a fluoroscopic examination of the thorax in the lateral direction is done and the diagonal axis of the heart and the curved line of the diaphragm are marked on the skin at the lateral surface of the thorax. The diagonal diameter is the line connecting the posterior point of origin of the aorta with the heart portion which fills out the sterno-diaphragmatic angle (Fig. 2). The patient then is placed on a chair with his head and thorax moderately bent forward; an x-ray film is placed into the cardiac groove, pushed backward as far as possible, and held in position by both hands of the patient. The x-ray tube is placed above the patient, the central ray is directed corresponding with the diagonal axis of the heart as marked on the patient's skin, entering the body through the upper dorsal spine and leaving through the sterno-diaphragmatic angle (Fig. 3). To avoid distortion for purposes of mensuration, care should be taken that the angle formed by the cassette with the central ray shall be exactly 90 degrees. The posture of the patient as well as proper centration should not offer any difficulties. Contrary to expectations, the films come

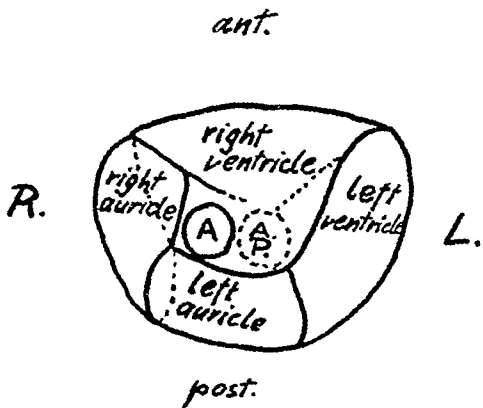


Fig. 5.

Fig. 5. Topographic anatomy of the heart as seen in a cross-sectional roentgenogram. (From Klason, *Acta Radiol.*, 11, 64.)

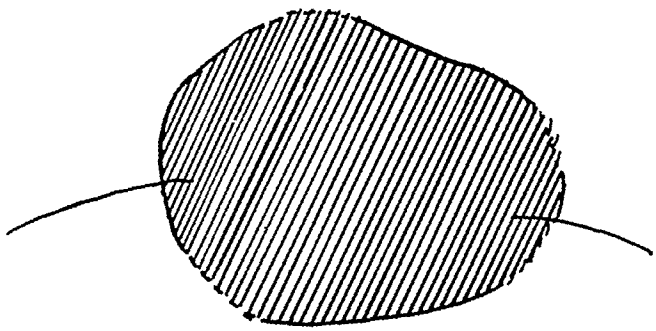


Fig. 6.

Fig. 6. Cross-sectional roentgenogram in moderate enlargement of the left ventricle.

out well defined (Fig. 4) and do not require great increase in kilovoltage or milliamperage. We use, on a two-disk mechanical rectifier, a radiation of from 80 to 83 kv.p., 80 ma., 1 m. target-film distance, and 0.2 sec. exposure time. In cases of marked obesity, marked enlargement of the liver, high abdominal tumors, pregnancy, and ascites, it is not possible to place the film sufficiently far backward to make a satisfactory examination possible.

In analyzing the radiographic picture, one must bear in mind that the film represents a horizontal cross-section through the heart within an oblique section through the thorax (Fig. 3). This is a fundamental point, because without this knowledge one would believe that the film was taken at a wrong angle and distorted. The radiogram reveals in the upper half, the ribs and lung structure corresponding to those portions located anteriorly and above the heart. The anterior surfaces of the diaphragm divide the film into an upper aerated and lower non-aerated portion. In the midline and vertical axis we note the blurred film of the cervical and upper dorsal spine bent forward during the exposure (Figs. 3 and 4).

Partly within the shadow of the diaphragm and partly projected anteriorly, we see the clearly defined egg-shaped "cross-section" of the heart. The topography of its different parts is known from anatomic studies and is well illustrated in a drawing by Klason (Fig. 5). In our projection, the right heart border is formed by the right auricle, the anterior by the right ventricle, the left by the left ventricle, and the posterior by the left auricle. These structures are anatomically located at different heights but on the film they are projected one over the other in *one* plane. Emerging anteriorly from the main heart shadow, we note on many films a triangular offshot, which is probably formed by the great veins. In hearts with a long vertical axis the vascular pedicle is visualized as a broad anterior projection. While the right ventricle anteriorly is frequently limited by a straight outline, the left one

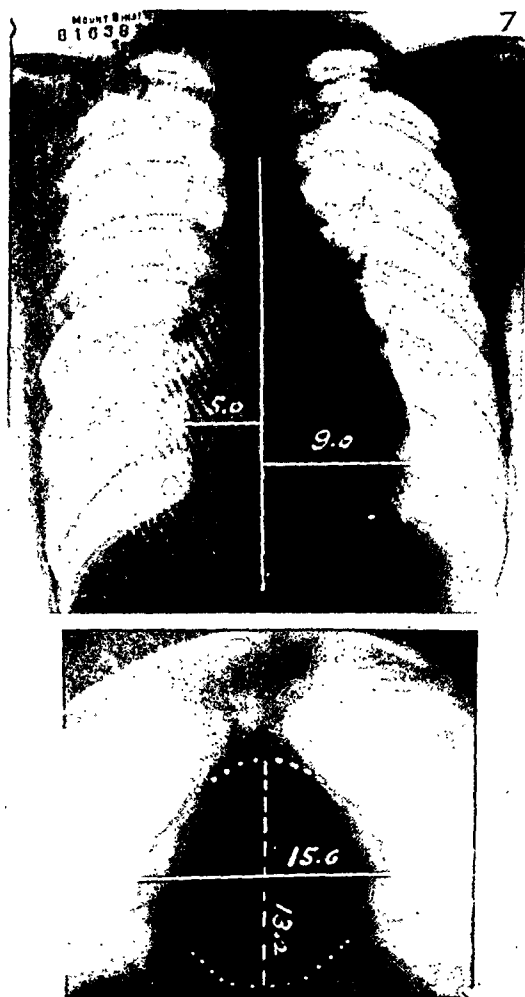


Fig. 7. Mitral stenosis. The posterior bulging of the left auricle is well visualized. The equation for the determination of the depth diameter is

$$\frac{x}{13.2} = \frac{14}{15.6} \cdot D = 11.8 \text{ cm.}$$

presents a distinct rounding. On many films the border between right and left ventricle is clearly marked (Fig. 4). The typical deformities of the heart are well demonstrated. In Figure 6 we note a moderate enlargement of the left ventricle. This, not infrequently, is directed forward and backward and the depth of the left ventricle is considerably increased. The lateral border of the enlarged ventricle often gives a blurred appearance which is probably due to a horizontal orientation of its longitudinal diameter. Figure 7 is a case of mitral stenosis with marked posterior bulging of the left auricle. The

degree of this bulging, which is first directed posteriorly and in a more advanced stage toward the right side, is easily recognized on a cross-section radiograph. Rotation of the heart around its vertical

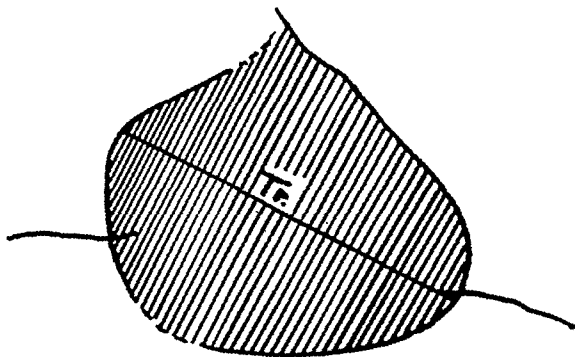


Fig. 8. Rotation of the heart in its vertical axis in a case of drop heart is well visualized on a cross-sectional film.

axis as in some cases of drop heart can be demonstrated, and compensation for the measurements taken on a typical six-foot film is then possible (Fig. 8).

This view gives valuable information for determination of the volume of the heart. If the diagonal axis has been carefully determined and placement of the cassette at a 90-degree angle with the central ray is strictly secured, mensuration of the depth diameter is possible. The correlation between the transverse diameter taken from a routine six-foot film with the transverse diameter of the cross-section radiograph will give the necessary factors for a simple mathematical equation. This permits the reduction of the non-distorted roentgenological cross-section to its actual measurements (Fig. 7).

SUMMARY

1. The fundamental anatomical and technical facts for taking a direct instan-

taneous "cross-section radiogram" of the heart are given.

2. The physiological angulation between the longitudinal axis of the thorax and the long axis of the heart is used to obtain, within an oblique section of the thorax, a clearly defined cross-section of the heart.

3. Not infrequently the border between right and left ventricle, not previously visible at all on any of the views used so far, is well defined.

4. Rotation of the heart in its vertical axis is well visualized.

5. Posterior enlargement of the left auricle, particularly its extension toward the right, is demonstrated.

6. If the technical requirements are exactly secured, this view is helpful for purposes of mensuration and volume determination. The measurements on the film have to be reduced to their actual values by correlating the measurement of the transverse diameter of a routine six-foot film to the transverse diameter as found on the cross-section view.

7. When this direct cross-section radiography of the heart can be obtained, it is superior to the methods based on the 360-degree rotation of the patient.

BIBLIOGRAPHY

- (1) GROEDEL, FRANZ M.: Der Querschnitt Zeichenapparat und Orthodiagraph. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 28, 155-158, 1921, 1922.
- (2) KLASON, T.: The Horizontal Orthoprojection of the Heart. *Acta Radiol.*, 11, 57-77, 1930.
- (3) LYSHOLM: Röntgenologischer Modellierungsapparat auch fuer Quersection und Localisation. *Acta Radiol.*, 7, 189-192, 1926.
- (4) PALMIERI, G. G.: Ueber meine Methode der plastischen Darstellung des Herzens am Lebenden. *Acta Radiol.*, 10, 127-166, 1929.
- (5) SCHATZKI, R.: Plastische grössen- und lagewahre Darstellung des Herzens. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 37, 899-905, June, 1928.
- (6) SZABADOS, M.: A Fluoroscope Attachment for Cross-section Drawing and Localization, with an Adaptation for Radiography. *RADIOLOGY*, 27, 689-695, December, 1936.

THE TREATMENT OF ERYSIPELAS WITH ULTRA-VIOLET ENERGY¹

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AMONG the multitude of remedies that have been advocated and employed for the attempted cure of erysipelas, there are only a few that have been definitely shown to be of any considerable value. The most prominent of these are roentgen radiation, erysipelas streptococcus antitoxin, and ultra-violet radiation. Comparative studies upon the relative efficiencies of these methods have been carried out by several investigators. The most convincing of these studies was reported by Ude and Platou, in 1930, in a study of 402 hospitalized cases treated by various methods at the Minneapolis General Hospital. They concluded that ultra-violet radiation was the treatment method of choice. Since that time most of the cases of erysipelas at the Minneapolis General Hospital have been treated solely by ultra-violet radiation. At the same time there has been a fairly widespread acknowledgment of the efficacy of this treatment so that there have been confirmatory reports from widely separated sections of the United States. Three of these reports I will combine in the present communication.

But first it is advisable to consider more closely the subject of ultra-violet radiation for the treatment of erysipelas.

Mode of Action.—At first consideration by one who has not seen the results from this treatment it would seem highly inadvisable to impose upon "St. Anthony's Fire" the added insult of a second degree burn from ultra-violet. In fact, the exact action of ultra-violet upon erysipelas has not yet been adequately explained. It is certainly not directly bactericidal in these cases. Titus says:

"In a preliminary paper published in 1933, the only conclusion reached was that the energy

increased the resistance of the tissues to the sensitizing action of the bacteria. This seemed the best lead, since frequently the entire lesion was shielded from the ultra-violet energy by pieces of cardboard, and irradiation of the surrounding tissues caused a clearing up of the infection. Radiation, with one part of the active inflamed edge covered by a piece of cardboard, stopped the advance of the entire inflamed edge and skin cultures of the radiated and non-radiated skin showed living bacteria. In the case of an infant the reaction produced on the head, where the lesion existed, was so severe that the next dose was given on the buttocks and lower back, and the disease was cleared up.

"One theory advanced by a worker at the Presbyterian Hospital is that the marked edema caused by these excessive doses of ultra-violet energy produce a specific antitoxin which is later absorbed. This is as yet unproven, but, if true, would be of great importance in the field of immunology."

The prolonged erythema produced by the ultra-violet energy may also be an important factor. This much is certain. The dosage of ultra-violet must be extremely heavy to produce the best results.

Technic and Clinical Course.—Experience has taught us that the dosage should be very heavy so that the original dosage suggested by Ude, namely, twice the erythema dose, has now been increased to from ten to twenty times the erythema dose. A border of three or four inches of normal skin around the involved area is included in the treatment. If multiple exposures are necessary, the edges are allowed to overlap. If the eyelids are not involved, the eyeballs are covered with black paper or cotton to prevent an ultra-violet conjunctivitis. If the eyelids are involved and swollen, the patient is merely instructed to keep his eyes closed during the treatment. Moist packs are prohibited for from 12 to 24 hours after the treatment, because they interfere with the proper development of the erythema. Usually no packs are necessary. If the skin feels stiff after the

¹ Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13-17, 1937.

erythema develops, a little white vaseline may be applied to relieve it. If spreading should occur, as evidenced by continued elevation of temperature and extension of the lesion, the same or an even heavier dose of ultra-violet is given the next day.

Most of the patients remark about the relief of pain which often occurs while the lamp is still being applied. Later there is some increased edema of both the area of erysipelas and the surrounding normal skin. This subsides in from 24 to 48 hours, and if no further spreads or complications occur, the temperature drops rapidly to normal, the treated area wrinkles, then desquamates, and in five or six days the entire area is replaced with fresh-looking skin. In the majority of cases only one treatment is necessary.

Comparative Statistics.—In the last few years the use of ultra-violet energy in the treatment of erysipelas has become sufficiently acceptable as the treatment of choice so that it is now possible to report the results in three widely separated portions of the United States and thus compare these statistics.

At the last meeting of the American Congress of Physical Therapy in New York in September, 1936, a paper on the treatment of erysipelas with ultra-violet radiation was presented by Dr. J. G. Jenkins, of Temple, Texas, which so closely paralleled the results found by Dr. N. E. Titus and myself, that Dr. Titus asked me to gather the comparable statistics of all three groups of patients into one paper to show the remarkable similarity of results in three widely separated sections of the United States as obtained by three groups of clinicians working in complete independence of each other.

Upon consideration of the factors which could be compared in these three series, it is evident that the comparison may be carried out under the headings of (1) the average number of treatments per case, (2) the average number of days from treatment to normal temperature, and (3) the deaths.

The comparative figures are shown in Table I.

TABLE 1

	Titus	Jenkins	Knapp
No. cases	81	50	510
Av. no. treatments	2.06	1.9	1.3
Av. no. days from treatment to normal temperature	4.58	3.13	3.75
No. deaths	2	1	38
Percentage of deaths	2.4	2	7.4

A consideration of the table shows that the average number of treatments per case and the average number of days from treatment to normal temperature are very nearly the same in the three series. The percentage of deaths is much greater in the Minneapolis series than in the others. It is probable that this can be explained by the fact that both Dr. Titus' and Dr. Jenkins' patients were largely private cases while my series was composed entirely of charity patients, many of whom waited until the last moment before allowing themselves to be taken to a hospital. In fact, 18 of these deaths were in cases in which some factor other than erysipelas was the primary cause of death. If these 18 are deducted from the 38 cases, there remain 20 deaths, or 3.9 per cent, which is fairly comparable to the other figures.

Results in Infants Less than One Year of Age.—Perhaps the greatest value of ultra-violet is shown in the treatment of erysipelas in infants. Erysipelas has always been feared as an extremely fatal disease in small children, with a mortality rate usually reported at from 50 to 75 per cent when treated by the older methods. In this series I have 15 children under one year of age with only two deaths. To this I can add three private cases without a death. This makes 18 cases with only two deaths, or 11.1 per cent.

Dr. Titus reports eight children under one year of age, with two deaths, or 25 per cent. Dr. Jenkins does not state how many patients were under one year of age. However, combining Dr. Titus' and my cases, there are 26 cases with only four

deaths. That is a mortality of only 15.3 per cent in cases of erysipelas in infants under one year of age.

CONCLUSIONS

1. Ultra-violet radiation is an effective treatment for erysipelas.

2. Reports from widely separated sections of the United States: *i.e.*, New York City, Temple, Texas, and Minneapolis, Minnesota, comprising a total of 641 cases, show strikingly comparable results.

REFERENCES

- (1) UDE, WALTER H., and PLATOU, E. S.: Erysipelas: A Comparative Study of the More Recent Methods of Treatment. *Jour. Am. Med. Assn.*, 95, 1-4, July 5, 1930.
- (2) UDE, WALTER H.: Erysipelas: Further Comparative Studies of the More Recent Methods of Treatment. *Arch. Phys. Therapy, X-Ray, Rad.*, 12, 16-18, January, 1931.
- (3) SYMMERS, DOUGLAS, and LEWIS, K. M.: The Antitoxin Treatment of Erysipelas: Further Observations. *Jour. Am. Med. Assn.*, 99, 1082, 1083, Sept. 24, 1932.
- (4) TITUS, NORMAN E.: Ultra-violet Light as a Method of Treating Erysipelas. *Med. Rec.*, 140, 259, 260, Sept. 5, 1934.
- (5) NIGHTINGALE, L. M., and STARR, S.: The Treatment of Erysipelas in Children: A Comparative Study Showing that Best Results are Obtained with the Use of Ultra-violet Radiation. *Jour. Am. Med. Assn.*, 102, 761-763, March 10, 1934.
- (6) PLATOU, E. S., and RIGLER, LEO: Roentgen-ray Therapy in Erysipelas. *Arch. Int. Med.*, 38, 573, November, 1926.
- (7) UDE, WALTER H.: Ultra-violet Radiation Therapy in Erysipelas. *RADIOLOGY*, 13, 504-507, December, 1929.
- (8) BROWN, R. KING: Treatment of Erysipelas by Ultra-violet Light. *British Jour. Phys. Med.*, p. 121, September, 1930.
- (9) TROUP, W. ANNANDALE: A Note on the Treatment of Erysipelas by Ultra-violet Irradiation. *Brit. Jour. Phys. Med.*, 7, 163, December, 1932.
- (10) TITUS, N. E.: Treatment of Erysipelas by Ultra-violet Light. *British Jour. Phys. Med.*, 9, 151, December, 1934.
- (11) Idem: Treatment of Erysipelas with Ultra-violet Light. *British Jour. Phys. Med.*, 11, October, 1936.
- (12) JENKINS, J. G.: Ultra-violet Radiation of Erysipelas. *Arch. Phys. Therapy*, 18, 363-365, June, 1937.

DIAGNOSTIC PNEUMOTHORAX

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INDUCED pneumothorax is recognized as an important therapeutic agent in pulmonary tuberculosis. However, the value of pneumothorax in diagnosis of diseases of the chest has not been emphasized sufficiently and consequently is not generally known. The recent technical advance in chest surgery demands the more widespread knowledge and utilization of all methods for more exact diagnosis.

Air used as a contrast medium in radiology is well established. Pneumography includes such procedures as ventriculography, encephalography, pneumoperitoneum, perirenal injection, double contrast enemas (barium and air), double contrast gastric visualization (barium and effervescent powders), and pneumothorax.

Brauer (1), in 1912, was the first to demonstrate pleural tumors radiographically by injecting air into the pleural cavity. His results and those of Schroeder (8), who reported in 1916, were not encouraging. In 1921, Fishberg (6) introduced this method in America, believing it might be of value in detecting early lung neoplasms. Caesar (3), Singer (9), Isaacs (7), Faulkner (4, 5), Bromme and others (2) have made contributions to the subject.

INDICATIONS

Pneumothorax has aided in the diagnosis of various chest conditions.

1. *Tumors of the Parietal Pleura.*—These tumors are well outlined because air is an excellent contrast medium which also collapses the lung, allowing an unobstructed view of the parietal pleura. Metastatic carcinoma, mesothelioma, and the various granulomas can be demonstrated. These are commonly associated with a pleural effusion which typically is

serosanguinous. After the fluid has been removed and air injected, x-rays are taken with the patient in that position which allows the fluid to gravitate away from the suspected area. Thus, if anteroposterior plates are taken with the patient in the left lateral recumbent position, the presence of the effusion along the mediastinum will allow a clear view of the parietal pleura of the right chest. The diaphragm can be visualized if the plates are taken with the patient in exaggerated Trendelenburg position. The entire pleural space can be explored by this method.

2. *Pleural Adhesions.*—The presence of pleural adhesions frequently is responsible for the failure of therapeutic pneumothorax. Air in the pleural cavity makes this complication visible.

Chest surgeons prefer to wait for the formation of pleural adhesions adjacent to a lung abscess before operating. However, it is difficult to know clinically or radiographically when such adhesions have formed. Faulkner (4, 5) performs pneumothorax routinely to determine the presence of adhesions. His classification, treatment, and prognosis of lung abscess depends largely on the x-ray findings following air injection. He believes there is little danger of empyema when the injection is made in an interspace distant from the abscess. However, most surgeons believe this procedure to be hazardous in lung abscess.

3. *Differentiate Intrapulmonary from Extrapulmonary Shadows.*—Although the stereoscope is most helpful in this problem, we have encountered several cases in which it has failed and pneumothorax has been successful. Plates are taken before and after intrapleural injection. Displacement of the shadow is evidence of intrapulmo-

nary pathology. Other factors being equal, the greater the displacement the more peripheral the lesion, and, conversely, a

Snure (10) believed it was of aid in the diagnosis of a mediastinal effusion. It enabled Isaacs (7) to differentiate an inter-



FIG. 1

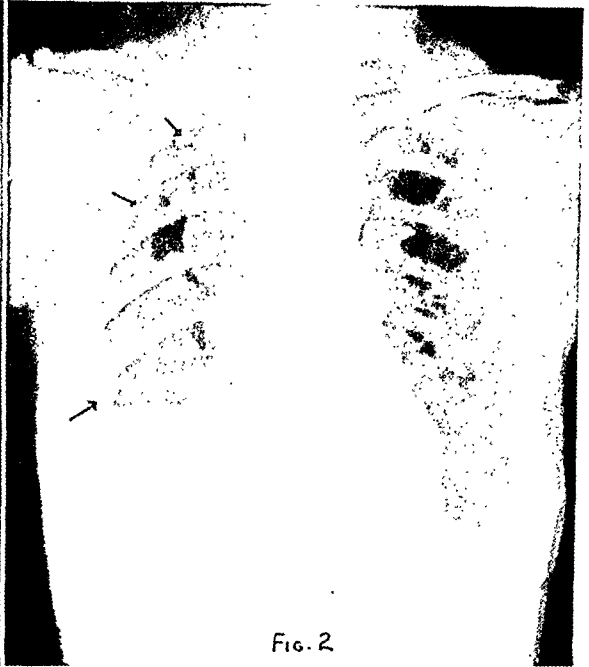


FIG. 2

shadow close to the mediastinum will be shifted but slightly. Extrapulmonary shadows (skin, subcutaneous tissue, muscle, rib, parietal pleura), of course, are not displaced by pneumothorax.

4. *Fibrin Bodies in the Pleural Cavity.*—Fibrin masses are occasionally seen in the pleural cavity of tuberculous patients who have developed effusions following repeated injections of air. Taylor and Bobrowitz (11) recently reported a series of 125 such cases. Such masses may be removed with the thoracoscope.

5. *Differentiate Pleural, Pericardial, and Mediastinal Effusion.*—Occasionally difficulties arise in the differential diagnosis of a left pleural, mediastinal, and pericardial effusion. The injection of air after aspiration of fluid will more definitely localize the fluid by outlining the serous cavity.

6. *Miscellaneous Conditions.*—Pneumothorax is occasionally used to define more clearly a suspected tuberculous cavity

lobar empyema from atelectasis. Singer (9), in two problem cases, outlined a bronchiectatic atelectatic lobe behind the heart shadow. He has also used simultaneously lipiodol and pneumothorax in bronchiectasis.

TECHNIC

The technic, dangers, and complications are similar to those of therapeutic pneumothorax. From 300 c.c. to 750 c.c. of air is sufficient in most cases. If a pleural effusion is present, approximately one-third of the volume of fluid removed is replaced with air.

CASES

Case histories are presented herewith, illustrating the diagnostic value of pneumothorax.

Case 1. A white woman, 49 years of age, entered the hospital because of progressive dyspnea, non-productive cough, fatigue, and loss of weight. Thirteen years previously a radical mastectomy of

the right breast had been performed for adenocarcinoma. Her subsequent course was uneventful until two months before the

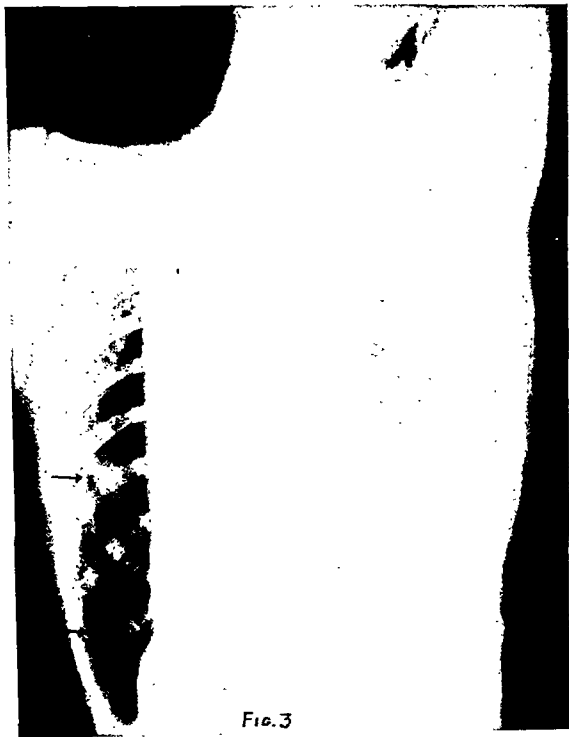


Fig. 3

present admission, when the above-mentioned complaints began. These continued with increasing severity up to the time of admission. Physical examination revealed signs of fluid throughout the entire chest (Fig. 1) and a hard mass in the right parasternal region. There were no subcutaneous masses or axillary nodes.

Thoracentesis of the right chest was performed. Serosanguinous fluid (2,000 c.c.) was withdrawn, and 600 c.c. air was introduced. Anteroposterior plates in the erect (Fig. 2) and left lateral recumbent (Fig. 3) position (the fluid thereby gravitating toward the mediastinum) visualized nodules in the parietal pleura. The pleural sediment, sectioned and stained, revealed clumps of adenocarcinoma. Aspiration biopsy of the right parasternal mass showed adenocarcinoma of the same type and degree of malignancy as that of the pleura.

Comment.—On admission, the patient

was suspected of having a latent metastatic carcinoma of the pleura, and parasternal node from the breast, which had been removed 13 years previously. The diagnosis was confirmed by pneumothorax, demonstrating pleural tumors; section and stain of the pleural sediment, disclosing adenocarcinoma, and by aspiration biopsy of the parasternal node.

Case 2. A white woman, 50 years of age, entered the hospital complaining of increasing dyspnea and painless swelling of the right arm. A right radical mastectomy had been done one year previously for adenocarcinoma. Physical examination revealed fluid in the right chest, large right axillary nodes, and lymphedema of the right arm.

Serosanguinous fluid (2,400 c.c.) was removed from the right pleural cavity and 750 c.c. of air introduced. X-ray examinations in the upright and the left lateral recumbent positions revealed nodules in the parietal pleura. The diagnosis of adenocarcinoma was made from the microscopical examination of the pleural sediment.

Comment.—This case is similar to Case 1. Whenever pleural tumors are suspected, or non-traumatic serosanguinous effusions are discovered, air should be injected into the pleura for diagnosis.

Case 3. A white man, 72 years of age, who had had a nephrectomy performed for a hypernephroma five years previously, entered the hospital with incessant non-productive cough, pain in the right chest, dyspnea, and weakness.

Physical findings were: slight dullness, diminished breath sounds and fremitus, occasional musical r le at the angle of the right scapula, and a palpable immobile deep mass, two inches in diameter, over the left fifth rib in the mid-clavicular line. X-ray examinations revealed a round shadow in the left lung-field, corresponding to the position of the palpable mass, and another in the right lung-field at the level of the fifth rib in the axillary line. The clinical diagnosis was latent hypernephroma metastases to the left fifth rib,

and to either the fifth rib or lung on the right side.

Induced pneumothorax of 400 c.c. of the right chest revealed the shadow to remain stationary while the lung collapsed. This was evidence that the shadow was extrapulmonary—probably in the rib. Postmortem examination verified the clinical impression.

Comment.—Stereoscopic views did not aid in determining whether or not the mass in the right chest was in the rib. Diagnostic pneumothorax excluded the possibility of its being a pulmonary metastasis because its position did not shift with collapse of the lung.

Case 4. A white woman, 52 years of age, entered this institution with indefinite history of fatigue and loss of 30 pounds in three months. Physical examination was negative except for evident loss of weight. X-ray examination of the chest showed a round shadow, one inch in diameter, in the right pulmonary field. Intravenous skiogram revealed flattening of the left upper calyx, suspicious of hypernephroma. Successive pneumothorax injections of the right chest, totalling 750 c.c. of air, caused a displacement of the shadow.

Comment.—In contradistinction to Case 3, this hypernephroma metastasized to the lung rather than to the rib. Pneumothorax revealed the lesion to be extrapulmonary in Case 3 and intrapulmonary in this case.

Case 5. A white man, 32 years of age, entered the hospital with a history of tuberculosis for one and one-half years. Pneumothorax was induced at that time, following which he had many refills. X-ray examination revealed a hydropneumothorax and fibrin bodies in the right cavity.

Comment.—Pneumothorax is of etiological and diagnostic importance in this instance. The repeated therapeutic use of pneumothorax is occasionally responsible for the formation of a pleural effusion. Fibrin bodies are sometimes found in the pleural cavity of these patients. The pneumothorax itself is of diagnostic aid in making these masses visible.

SUMMARY

1. A short history of the use of diagnostic pneumothorax is given.
2. The indications and technic of the method are described.
3. Case histories are presented and relevant comments are made.

Acknowledgment is made to Samuel F. Weitzner, M.D., of Morrisania City Hospital, and Bernard Ehrenpreis, M.D., of Kings County Hospital, for their technical assistance and helpful suggestions.

BIBLIOGRAPHY

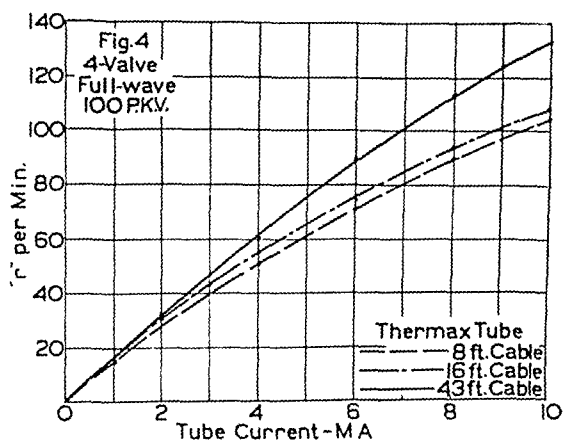
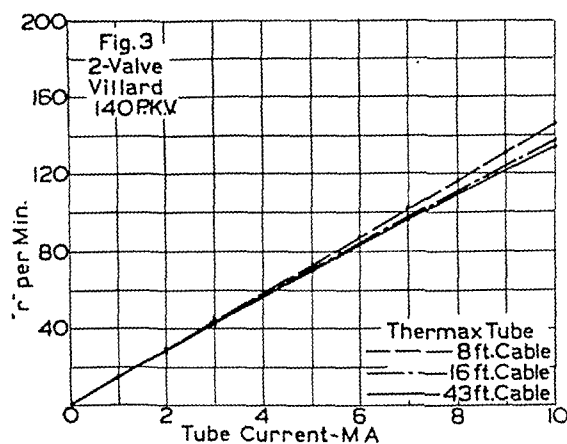
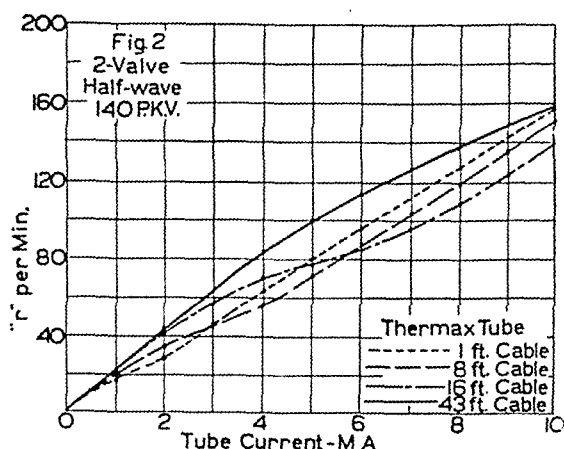
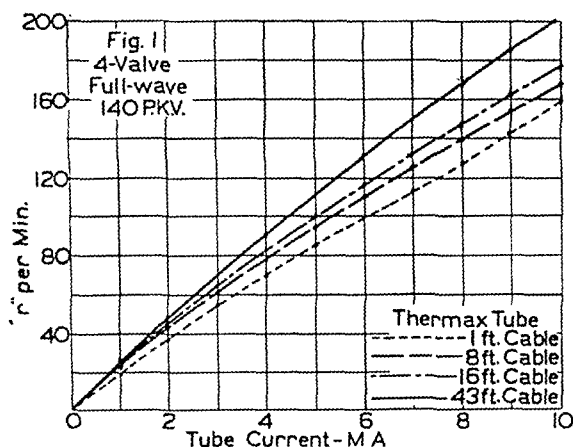
- (1) BRAUER, L.: Diagnosis of Pleural Tumors. *München. med. Wchnschr.*, 59, 1192, 1912.
- (2) BROMME, W., NELSON, H. P., and FINLEY, T., JR.: Case of Delayed Metastatic Sarcoma of Pleura Illustrating Diagnostic Value of Artificial Pneumothorax. *Am. Jour. Cancer*, 24, 334-339, June, 1935.
- (3) CAESAR, F.: Pneumothorax in Diagnosis. *Zentralbl. f. Chir.*, 51, 683, 684, March 29, 1924.
- (4) FAULKNER, W. B., JR.: Diagnostic Pneumothorax: Guide in Localization, Treatment, and Prognosis of Pulmonary Abscesses. *Am. Jour. Surg.*, 14, 646-651, December, 1931.
- (5) FAULKNER, W. B., JR., and FAULKNER, E. C.: Diagnostic Pneumothorax: An Aid in the Diagnosis of Pleural Tumors. *RADIOLOGY*, 18, 1023-1027, May, 1932.
- (6) FISHBERG, M.: Discernment of Intrathoracic Neoplasms by Aid of Diagnostic Pneumothorax. *Jour. Am. Med. Assn.*, 76, 581, 1921.
- (7) ISAACS, H. J.: Diagnostic Pneumothorax. *Am. Jour. Roentgenol. and Rad. Ther.*, 13, 250, 1925.
- (8) SCHROEDER, G.: Internat. *Centralbl. f. d. ges. Tuberc. Forsch.*, 10, 354, 1916.
- (9) SINGER, J. J.: Diagnostic Pneumothorax. *Am. Clin. Med.*, 4, 907, 1925.
- (10) SNURE, HENRY: Mediastinal Pleurisy. *RADIOLOGY*, 18, 1028-1032, May, 1932.
- (11) TAYLOR, H. K., and BOBROWITZ, I. D.: Fibrin Bodies in Artificial Pneumothorax. *Quart. Bull. Sea View Hosp.*, 2, 127-136, January, 1937.

EFFECT OF CABLE LENGTH ON RADIATION OUTPUT OF SHOCK-PROOF X-RAY TUBES

By T. H. ROGERS, M.E.E., Field Engineer, Machlett Laboratories, Inc., Springdale, Conn.

THE rapidly increasing and already widespread use of shock-proof tubes of the cable type for roentgenological purposes gives importance to a consideration of the effect of the capacitance repre-

shock-proof tube of the Machlett Thermax type under various conditions of cable length, load, and type of energizing circuit. The generator for energizing the tube consisted of a Kelley-Koett Type GA



sented by various lengths of shock-proof cable on the radiation output of such tubes. This report presents the results of a series of tests which give some definite indications of how the length of cables employed may affect output under a considerable variety of conditions, and certain conclusions which it is possible to draw from these tests.

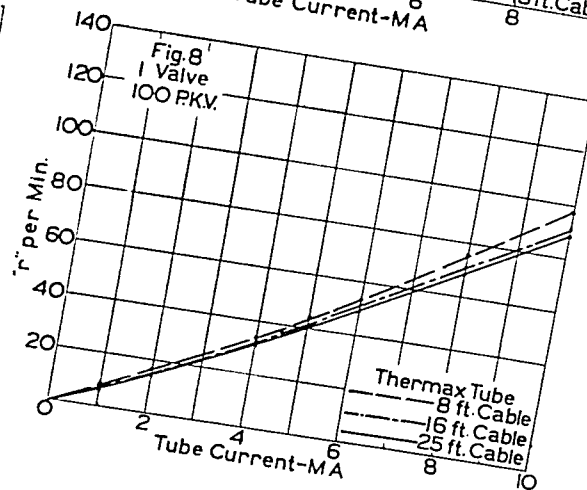
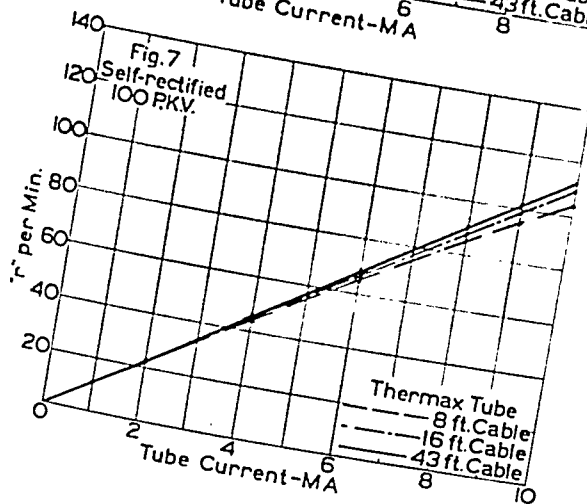
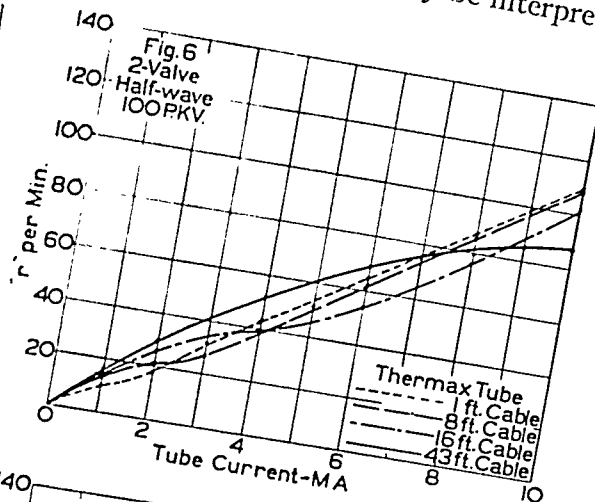
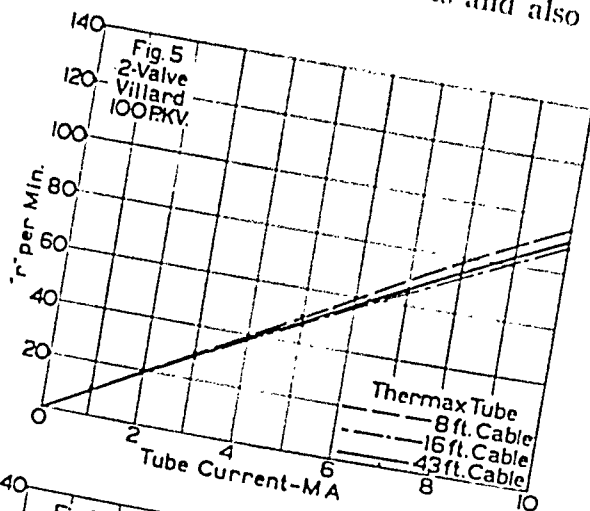
The tests consisted largely of measurement of r output from an oil-immersed

transformer, of 50 ma., 200 kv.p. capacity, continuous rating, specially equipped with a flexible arrangement of valve tubes which can be connected so as to produce various types of rectified and unrectified circuits at will, with the exception of the Villard circuit. Measurements were also taken with the tube being operated on a Waite and Bartlett 30 ma., 200 kv.p Villard circuit therapy generator.

Readings of r output were taken as a

function of milliamperage through a range from zero to 10 ma., at 140 kv.p. on circuits of the 4-valve full-wave, 2-valve half-wave, and Villard types, respectively, and at 100 kv.p. on these circuits and also on

any of the sets of conditions involved, since various other factors which are peculiar to any individual installation will further influence this value. However, the results can readily be interpreted



single-valve and self-rectified half-wave circuits, the voltage rating of the tube being inadequate to permit employing 140 kv.p. with the two latter types of circuits. Various cable lengths were employed under each condition. All r measurements were made with a Victoreen condenser type r meter, at 40 cm. focal distance, in air, without cones, and except where otherwise noted, without external filtration.

The r output values obtained under the various conditions are given in detail in Figures 1 to 8.

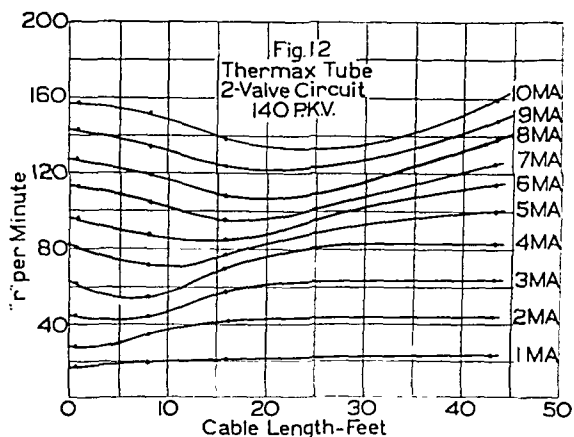
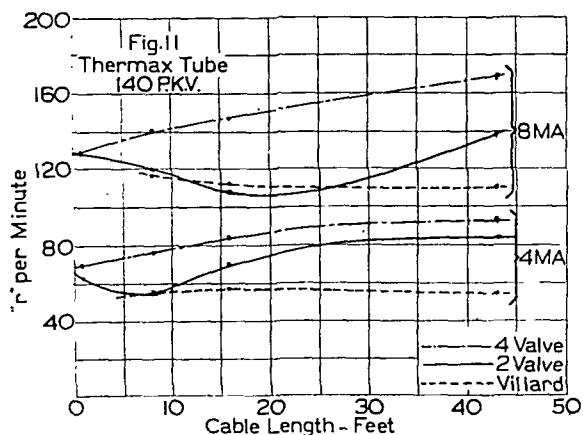
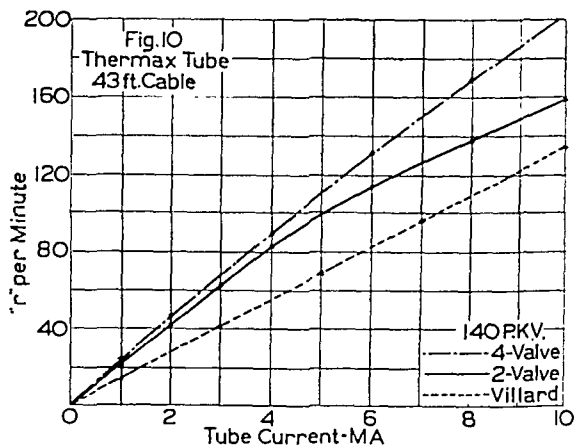
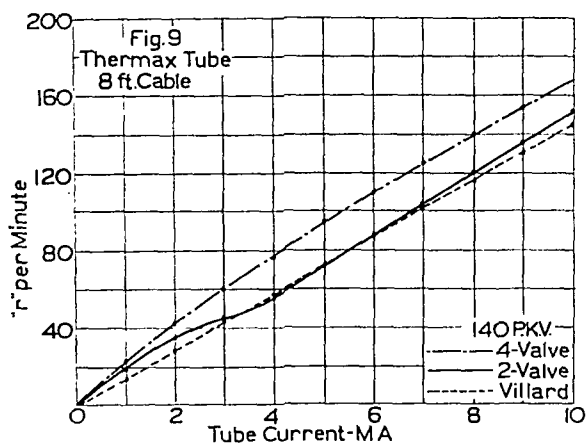
These tests do not attempt to establish quantitatively the output obtainable under

to indicate qualitatively how the length of cables will influence the intensity of radiation output under various operating conditions within the range covered. The particular generators used in these tests have very large capacities in comparison with the loads employed, so that effects associated with the loading characteristics of the machines and heating of the tube which was used are largely eliminated. The tube which was employed employs cables having a capacitance of approximately 60 mmf. per foot. The lengths indicated are length of each cable, two being employed in all cases. This tube has an inherent filtration value approximately

equivalent to about 0.6 mm. of aluminum. The inherent "bias" in the Thermax is relatively low, being equivalent in this respect to the usual radiographic tube, although it is designed for both radio-

applicable to tubes of other types as well as the type employed in these tests.

Discussion of Results.—In the charts of Figures 1 to 8, output is plotted as a function of milliamperage with cable length



graphic and therapeutic application. Thus, any effects which would result from a high bias in the tube are also eliminated.

The applicability of the results to other types of tubes were checked by repeating representative measurements, at 100 kv.p., using a radiographic tube (Machlett type CYR) and an air-cooled, bulb-type, light-therapy tube (type XLT), with cables of various lengths connected to the tubes. Results for identical conditions checked those obtained with the Thermax tube within reasonably close limits, indicating that conclusions based on the data presented in this report are qualitatively

as a parameter, each chart representing a different circuit or kilovoltage. It is readily apparent that the effect of cable length varies greatly depending on the type of circuit. For example, Figure 1 indicates that on a 4-valve full-wave generator output increases with cable length at all values of milliamperage within the range of the test; Figure 3 indicates that output varies only very slightly with cable length in the case of the Villard circuit generator, and from Figure 2, it is seen that on the 2-valve half-wave generator the effect of cable length depends largely on the value of milliamperage. Figures 4, 5, and 6 give similar

indications for the three respective types of circuits at 100 kv.p., Figures 1, 2, and 3 being for 140 kv.p., Figures 7 and 8 indicate that cable length has little influence on r output on self-rectified and single-valve circuits.

The data obtained from these tests may also be plotted in other forms so as to show more clearly other comparisons which may be drawn among the various operating conditions. A chart such as Figure 9 will show the relative efficiencies of various types of circuits. However, the conclusions drawn from such a chart can be valid only for the one value of cable length, since a similar chart for a different length of cables may give an entirely different indication. In Figure 9, which applies to a cable length of eight feet, it appears that the 2-valve half-wave and the Villard circuits are practically identical in efficiency at most values of milliamperage, with the 4-valve full-wave circuit showing a somewhat higher efficiency. With cables 43 feet long, as shown in Figure 10, a very considerable divergence in the efficiency of the three circuits appears, the 4-valve circuit giving the highest output, the 2-valve circuit somewhat lower, and the Villard circuit lowest of all.

The influence of cable length on output can be most clearly shown by plotting r per minute as a function of cable length. Such charts should be made for each milliamperage value of interest, as the effect of cable length varies with milliamperage on some circuits. Figure 11 shows curves of this kind for three circuits at 4 ma. and at 8 ma. These charts show that output increases with cable length on the 4-valve circuit, varies very little with cable length on the Villard circuit, and varies in a rather interesting manner, as discussed in the second paragraph below, on the 2-valve circuit.

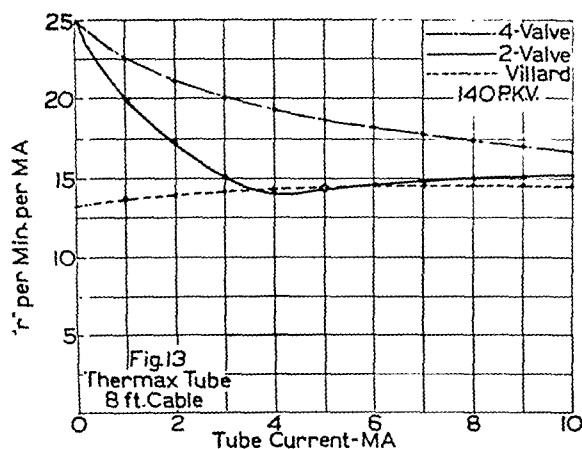
Another method of comparing the efficiencies of the various circuits is to reduce the output values to terms of r per minute per ma., plotting charts such as Figures 13 and 14 for various values of cable

length. The variation in efficiency with milliamperage for the various operating conditions is most clearly shown by means of such charts.

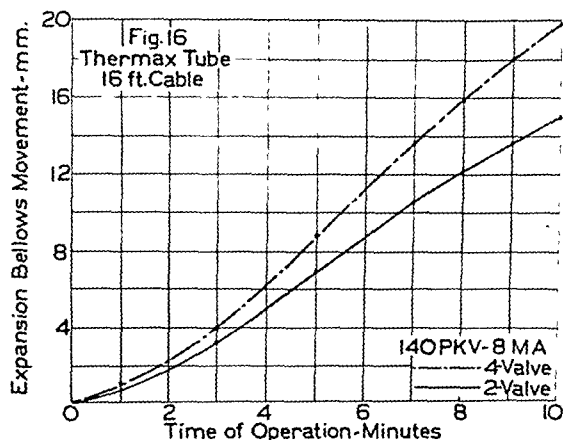
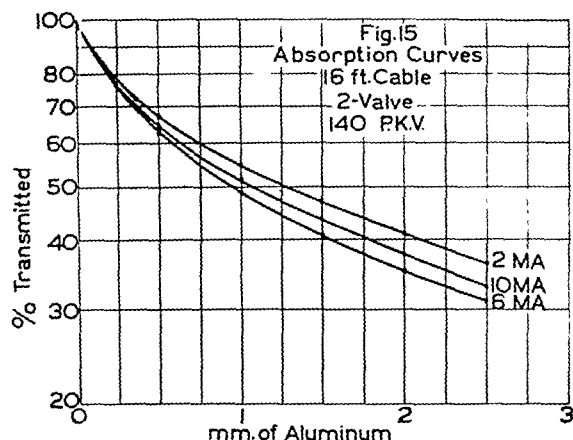
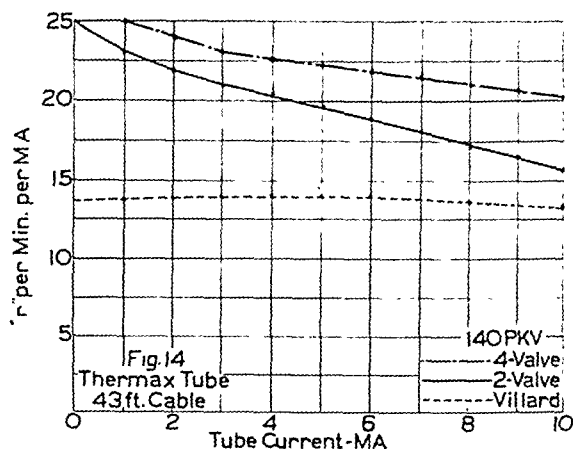
Probably the most interesting phenomena exhibited by these tests are the variation in output with cable length on the 2-valve circuit and the relation between the 2-valve and 4-valve circuits in this respect. Figures 2 and 6, taken together, clearly show that on the 2-valve circuit cable length influences output to a very great extent, but whether any given change in cable length will increase or decrease output depends on both milliamperage and kilovoltage of operation. The variation in output with both cable length and milliamperage at a fixed kilovoltage can be shown in an interesting manner by a chart such as Figure 12, giving values of r output as a function of cable length with milliamperage as a parameter. It can thus be seen that, as cable length is increased, output decreases, reaches a minimum, and then increases with further increase in cable length, tending toward a value considerably higher than the starting point. The cable length at which the minimum output occurs varies with milliamperage, being greater for higher values of milliamperage. These variations are of such magnitude that it may be observed, for example, that the output at 6 ma. with 43-foot cables is higher than the output at 8 ma. with 16-foot cables.

The reasons for these perhaps surprising effects become quite obvious from an analysis of the usual 2-valve circuit to which capacitance as represented by the cables has been added. Such a circuit is shown schematically in Figure 17. The voltage output of such a circuit with zero value of capacitance would theoretically have the form indicated in Figure 18-A. With successively greater values of capacitance, the voltage wave will assume in turn the forms indicated in Figures 18-B, 18-C, 18-D, and 18-E. Figure 18-C represents the condition which results in the minimum output for any given value of milliamperage. Figure 18-B corresponds to a smaller

value of capacitance than 18-C, Figure 18-D to a somewhat larger value than 18-C, and Figure 18-E corresponds to a very large value which is sufficient to maintain the voltage practically constant, producing



The results obtained with the 4-valve circuit appear to be quite different from those of the 2-valve circuit. Here output increases steadily with increase in cable length throughout the range of milliamperage-



the condition resulting in maximum output. The value of capacitance necessary to produce any of these conditions will obviously vary with the milliamperage drawn by the tube, which accounts for the fact that the point of minimum output varies with milliamperage.

It is strikingly evident that this circuit is most inefficient in the range of cable length and milliamperage usually employed for superficial and intermediate therapy applications. Figure 12 immediately suggests that this efficiency can be greatly increased by adding additional capacitance to the circuit, which might be in the form of condensers connected so as to add to the capacitance of the cables.

age from zero to 10 ma. However, it would be necessary to considerably extend the milliamperage range to fully check the action of the 4-valve circuit in this respect. It can be observed that the action of the 2-valve circuit between zero and 2 ma. is quite similar to that of the 4-valve circuit between zero and 10 ma. If the range were extended to, say, 50 ma., it is entirely possible that effects similar to those observed with the 2-valve circuit would occur with the 4-valve circuit. Milliamperages of this order being in the radiographic range, an investigation of this nature for 4-valve full-wave circuits would be of interest in relation to the influence, if any, of the capacitance of different lengths of shock-proof

cables on the radiographic effect at various kilovoltage and milliamperage factors. If such variations in intensity are appreciable, they would have a bearing on the proper technics to be employed for any desired radiographic results.

Fig 17
2-Valve Circuit with
Cable Capacitance

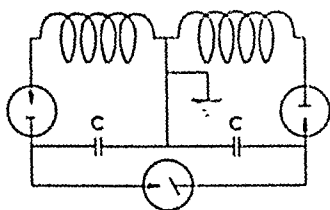
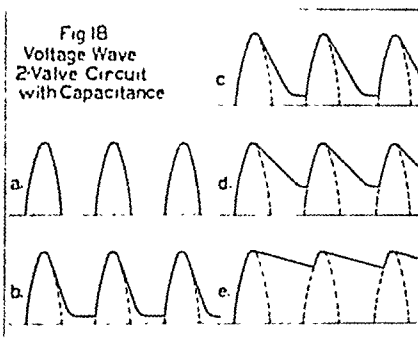


Fig 18
Voltage Wave
2-Valve Circuit
with Capacitance



With the Villard, single-valve, and self-rectified circuits, no considerable effect of cable capacitance on output is observable. While at first thought it might be expected that these results would be in general similar to those with the 2-valve half-wave circuit, analyses of the respective circuits show that in the 2-valve case, the charge on the cables is discharged through the x-ray tube only, whereas in these cases, the cables are able to partly or wholly discharge back into the generator, the discharge not being blocked by valve tubes.

In view of the fact that the variations in output noted above appear at both 140 kv.p. and 100 kv.p. in the same general manner, it seems likely that similar variations will occur at higher voltages. Hence, the results of these tests also give some indication of the effect of cable capacitance on output to be expected in shock-proof deep therapy installations employing these various circuits.

Variations in quality as well as quantity of radiation would also be expected under the various conditions involved. Absorption curves for typical conditions throughout the range represented by these tests would indicate the nature of such variations. To bring out an interesting fact, aluminum absorption curves were taken

on the 2-valve circuit, with 16-foot cables at 140 kv.p. for three different values of milliamperage. These curves are shown in Figure 15. At 2 ma., the half value layer is 1.3 mm.; at 6 ma., 0.95 mm.; at 10 ma., 1.07 mm. Thus a very con-

siderable change in quality is effected merely by changing the milliamperage under such conditions.

There is also the question of energy input to the tube under the various conditions. It would be expected that at a given kilovolt peak and milliamperage load, a condition giving the higher *r* output would subject the tube to a higher thermal load. This point was checked for the 2-valve and 4-valve circuits at 8 ma. and 140 kv.p. load, 16-foot cables being employed in both cases. The method of comparing thermal input consisted of measuring the movement of the expansion bellows. In both cases the tube was operated for ten minutes, starting at room temperature, with the normal flow of cooling water turned off entirely, and the position of the bottom of the expansion bellows was noted at the beginning and end, and at intervals during the run. Movement of the bellows, in millimeters, is shown in Figure 16 as a function of time. The relative position at the end of ten minutes indicates approximately a 30 per cent greater thermal input for the 4-valve circuit. A comparison between Figures 1 and 2 for the same conditions shows approximately a 40 per cent higher *r* output for the 4-valve circuit. Thus, it would appear that the increase in *r* output is accompanied by a somewhat

lesser increase in thermal input. A greater gain in efficiency in such cases would probably be apparent if added filtration is used with the tube, since there would be less absorption in the filter when the condition giving the higher r output was employed.

SUMMARY

The tests made permit drawing the following qualitative conclusions:

When an x-ray tube equipped with shock-proof cables is operated at the load factors customary for superficial and intermediate therapy, the effect of the cable capacitance depends upon the type of circuit employed in the generator. In general, if the circuit is of the 4-valve full-wave type, the r output of the tube will be considerably increased as a result of the addition of the cable capacitance; in the case of a 2-valve half-wave circuit, the r output may be either increased or decreased, depending to a very marked degree on the milliamperage and voltage factors and the exact value of cable capacitance. Cable capacitance has very little effect in the case of Villard circuit, single-valve, and self-rectified generators. No tests were made on mechanically rectified generators.

The results of these tests suggest the possibility of some effects at radiographic loads with a 4-valve full-wave circuit which

may have important bearing on radiographic results under such conditions. Further investigation of such conditions is indicated.

The results of any comparison of the relative efficiencies of different types of generators depend very much on the length of cables employed. With a 2-valve half-wave generator, cables of the usual length are likely to result in a relatively very inefficient condition in regard to r output. The results of these tests lead to the suggestion of connecting additional capacitance in the form of condensers across the terminals of such a generator to increase the output.

Quality of radiation also appears to be influenced by cable capacitance. This factor was not fully investigated, but it is indicated that conditions which produce higher values of output per ma. also produce radiation of greater penetration as evidenced by greater half value layer of aluminum.

Thermal energy absorbed by the tube at a given milliamperage and peak kilovoltage load also varies with conditions involving cable capacitance. It is indicated that conditions producing higher r output also involve a greater thermal load on the tube, but the increase in output is greater than the increase in thermal load.

THE USE OF ROENTGEN THERAPY IN THE CAROTID SINUS SYNDROME¹

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From the Department of Radiology, Scott and White Clinic

IT is the purpose of this paper to present five cases in which roentgen therapy has been used for the treatment of the carotid sinus syndrome. Radiologists have irradiated the autonomic nervous system for various pathologic conditions, but as a whole the results have been discouraging, and many look upon roentgen therapy in this field with considerable skepticism.

For many years physiologists have been interested in the slowing of the heart rate which can be induced by pressure over the vagus nerve. All authors now give credit to Hering for demonstrating the true nature of this reflex. He showed that this reflex arose as a result of pressure over the carotid sinus with its rich supply of autonomic nerve fibers.

The carotid sinus is a bulbous dilatation of the internal carotid artery at its point of origin from the external carotid artery. Some variation in its location has been described but it is always in close relationship to the area where the internal and external carotids arise from the common carotid artery. One point of practical interest to the radiologist is that this bifurcation may be located at various levels in the neck from just above the angle of the jaw down to the thyroid gland. Most commonly, however, it is located just below the angle of the jaw.

The wall of the sinus is thinner than the adjacent parts of the artery owing to a decrease in the size of the media. The adventitia is richly supplied with sensory receptors. This network of nervous tissue leaves the carotid sinus as the sinus nerve. The most direct connection is with the glosso-pharyngeal nerve. The vagus and superior cervical ganglia are also con-

nected with the sinus nerve. Some investigators claim there is a connection with the hypoglossal nerve.

It has been conclusively demonstrated that the nerve impulse arising from the carotid sinus can be due to stretching or distention of the sinus from within or by pressure on the outside of this area. The impulses travel centrally to the medulla, and from the medulla the efferent pathways may be along the vagus and vasomotor depressor nerves to the periphery or to the cortex by the way of the thalamic region.

The carotid sinus syndrome may be bizarre or consist simply of syncope of varying duration. It is usually possible to explain the symptoms on the basis of the efferent pathways, either to the periphery or to the cerebral cortex. Usually three reflex areas may account for the clinical picture: a vagal reflex resulting in cardiac slowing or standstill; a vasomotor reflex resulting in a fall of blood pressure; or a cerebral reflex which may cause syncope without significant changes in pulse rate or blood pressure.

Etiology.—Sigler found that arteriosclerosis and hypertensive heart disease were common in a large group of patients who had cardiac slowing on pressure over the carotid sinus. He showed also that the reflex slowing of the heart by carotid sinus pressure is more common in males than females and that it is more frequent in the older-age groups.

Weiss and his co-workers reported a large group of cases and found local disease of the sinus in many instances. Dilatation or sclerosis of the sinus and cervical adenitis were common, and general constitutional disease existed in some of these patients.

Clinical Manifestations.—Attacks of unconsciousness, with or without convulsions,

¹ Read before the Texas State Radiological Society, Oct. 22, 1938, at San Antonio, Texas.

occurring at varying intervals is the most common complaint. Smith and Moersch reviewed a series of these cases and concluded that the attacks may be characterized by light-headedness, ringing in ears, blurring of vision, and numbness of extremities. Objectively, there may be pallor, sweating, dilatation of the pupils, exophthalmos, slowing of the pulse rate, and cardiac standstill.

The attacks usually come on while the patient is in an upright position and may be relieved by lying down, if the promontory symptoms are of sufficient duration. The attacks may be precipitated by sudden movements of the head and neck or by pressure or blows on the neck. General constitutional disorder, such as emotional upsets, fatigue, and menstruation, may be a predisposing factor.

Treatment.—Any obvious local or systemic disease associated with the carotid sinus syndrome should be treated. Specific drug treatment has been based on the type of reflex causing the symptoms. A drug with the proper physiological action is chosen to interrupt the abnormal reflex. This drug therapy has not been of great value in prophylaxis.

Surgical denervation of the carotid sinus has been done with good results. The operation is not without hazard however.

In hope of affording some relief to these patients with a hypersensitive carotid sinus, roentgen therapy was used as the only specific type of treatment in the following five cases.

Case Reports.—Case 1. R. T., white man, 37 years of age, entered the clinic on Dec. 3, 1937, with a chief complaint of "blank spells." His first attack came on one month before admission and was characterized by a loss of consciousness for about one minute. There were no convulsions, but after he regained consciousness he noticed a tachycardia. After his heart rate subsided to normal he developed a generalized headache. The patient experienced two more of these attacks before entering the clinic.

All laboratory examinations were essentially negative and physical examination did not disclose any disease or abnormality except in regard to the carotid sinus. It was possible to exactly duplicate the patient's attacks by moderate pressure over the carotid sinuses. A diagnosis of hypersensitive carotid sinus was made and roentgen therapy was given to both sides of the neck.

The patient returned for observation on Jan. 17, 1938. He had had no attacks since his treatment with x-ray. It was impossible to reproduce his attacks by pressure over the carotid sinuses. In hope of added prophylaxis, a second course of roentgen therapy was given. The patient was again seen on June 21, 1938. He had been feeling perfectly well and had not had any attacks. It was impossible to demonstrate a hypersensitive carotid sinus at that time. The patient was last heard from on Oct. 10, 1938. He had had no attacks up to the time of that communication.

Case 2. G. M., white man, 27 years of age, entered the clinic on Jan. 7, 1938, with a chief complaint of "fainting attacks." He gave a history of having his first fainting spell two years before admission. This attack was characterized by dizziness, marked blurring of vision, and mental confusion. He did not entirely lose consciousness. There were several of these attacks during the first year, but in the year before admission they had decreased slightly in number but not in severity.

All laboratory data were essentially negative. Physical examination showed no evidence of disease or abnormality except in regard to the carotid sinuses. It was possible to reproduce the patient's attack by moderate pressure over the carotid sinuses, and a diagnosis of hypersensitive carotid sinus was made and roentgen therapy given.

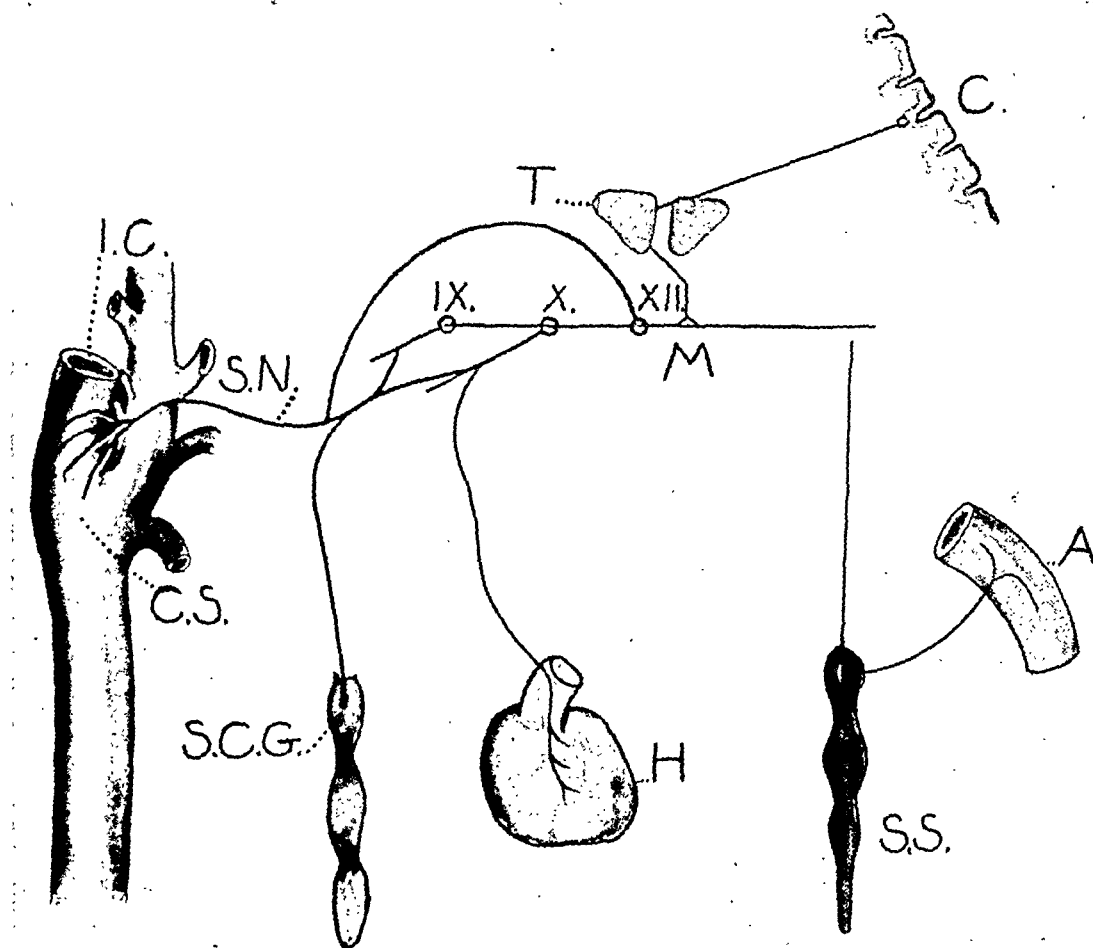
The patient returned on Feb. 10, 1938, giving a history of having had no attacks since the previous admission. It was impossible to reproduce his attacks by pressure over the carotid sinuses. A second

course of roentgen therapy was given and the patient then was dismissed. When last heard from on Oct. 11, 1938, he had had no attacks and was feeling fine.

head, blurring of vision, and inability to speak. Consciousness was not lost, and there were no cardiac symptoms. The last attack, two weeks before admission, was preceded by his usual symptoms;

Case 3. B. H., white man, 28 years of

THE CAROTID SINUS AND ITS RELATIONSHIP TO THE AUTONOMIC NERVOUS SYSTEM



I. C.—Internal carotid artery; C. S.—Carotid sinus; S. N.—Sinus nerve; S. C. G.—Superior cervical ganglia; IX—Glosso-pharyngeal nerve; X—Vagus nerve; XII—Hypoglossal nerve; M.—Medulla oblongata; H.—Heart; T.—Thalamus; C.—Cerebral cortex; S. S.—Sympathetic system; A.—Arterioles.

age, entered the clinic on Jan. 26, 1938, with a chief complaint of "fainting spells." He had had these attacks over a period of 10 or 12 years and at extremely varying intervals. The attacks were always characterized by a feeling of fullness in the

but there then followed unconsciousness and convulsions for a few minutes.

The results of all laboratory tests were essentially negative, and there was no clinical evidence of disease other than the hypersensitive carotid sinuses. Pressure

moderately applied to both carotid sinus areas duplicated the patient's last attack. An electrocardiographic tracing made at the same time that pressure was applied showed a slowing of the pulse and a period of complete asystole for 2.1 seconds. The blood pressure dropped from 120 to 100 mm. of mercury systolic during the period of cardiac slowing. A diagnosis of carotid sinus syndrome was made and roentgen therapy given.

The patient returned on March 3, 1938, with a history of having had two mild attacks a few days before readmission. The attacks could be reproduced by pressure over the carotid sinus, and a second course of roentgen therapy was then given. The patient returned for observation on May 13, 1938. He had had one attack of fairly severe intensity about three weeks before. His attacks could be reproduced, and a third course of roentgen therapy was given. The patient has felt well since his last treatment and was last heard from on Oct. 10, 1938. He had had no attacks up to that time.

Case 4. M. S., white woman, 60 years of age, first entered the clinic on June 24, 1922, with a chief complaint of "fainting spells." At that time it was difficult to account for these spells for no abnormal changes could be elicited. The cardiovascular system was essentially normal, and the patient was placed on digitalis therapy. She was next seen on May 13, 1938, with the same chief complaint she had given in 1922. There had been many attacks over this 16-year period. The only symptoms had been dizziness followed by fainting. Recovery promptly ensued when she was in a reclining position.

All laboratory examinations were within normal limits. The blood pressure was 150 mm. of mercury systolic and 70 mm. of mercury diastolic. There were no other cardio-vascular observations of importance. Pressure moderately applied over both carotid sinuses duplicated her attacks. Roentgen therapy was given, and when the patient was last heard from on

Oct. 1, 1938, she had had no attacks since receiving treatment.

Case 5. R. M., white man, 66 years of age, entered the clinic on Aug. 1, 1938, with a chief complaint of "dizzy spells." These spells had occurred at varying intervals during the past five years but had become more frequent and severe during the past two years. The attacks consisted of vertigo and blurring of vision lasting from about 10 to 15 minutes. Sudden changes in position of the head seemed to cause the attacks.

The results of laboratory studies were within normal limits. A roentgenogram of the chest showed marked calcification and torsion of the arch of the aorta. The patient's attacks could be duplicated by pressure over the carotid sinuses, and an electrocardiographic tracing made at the same time the pressure was applied showed slowing of the cardiac rate and a period of complete asystole for five seconds.

Roentgen therapy was given, and when the patient was last heard from on Oct. 12, 1938, he reported that he had been completely free from his former attacks.

DISCUSSION

Many cases of hypersensitive carotid sinus have been reported; hence the five cases reported here are not described in detail. A more thorough clinical description of this entity may be found in the literature reviewed in this study.

In each of these five cases the attacks that caused the patient to come to the clinic have been reproduced by pressure over the carotid sinuses. The same physician who originally examined the patient attempted to duplicate the attacks after roentgen therapy was given.

Pfahler has mentioned that roentgen therapy of the sympathetic nervous system probably does its good because the ganglia are inflamed or hypersensitive.

Langer reported many cases in which roentgen therapy was given over various sympathetic nerve centers. He has stated that the results have been due to a depression of the sympathetic ganglia. He used

a fairly hard ray obtained with 200 kv. and 0.5 mm. of Cu as filter.

Kremer and Laplace report a case of heart block following roentgen therapy for thyrotoxicosis. They evidently used a very small amount of radiation and claim that the heart block was due to a sensitization of the carotid sinus by roentgen therapy.

Following the dictates of the Arndt-Schutz law² all five cases reported here were given a moderate dose of roentgen therapy with the expectation of inhibiting or lessening the sensitivity of the nervous tissue around the carotid sinus.

The technical factors used are 165 kv. (constant potential), 0.5 mm. of copper and 1 mm. of aluminum as filter, and 50 cm. target-skin distance. A 10 × 10 cm. cone was centered over the area in the neck where the clinician was able to reproduce the attacks by pressure. Five hundred r (measured in air) were given in a single dose to one side of the neck. The next day the same dose was given to the opposite side.

When the therapy was repeated at a later date the same technical factors and dosage were used. There were no systemic reactions, but a mild parotitis was noticed by all patients. This subsided in a day or two.

In this small group of cases, one patient required three courses of roentgen therapy to accomplish the desired results. The remaining four responded to one course of treatment.

This group of cases is too small to give any definite statistics, and no definitive conclusions may be drawn. To date, there seems to have been actual prophylactic value to the roentgen therapy. The actual duration of this beneficial action remains to be seen.

Smith and Moersch state that drug therapy is not satisfactory for prophylaxis. Surgical denervation of the carotid sinus is a technically difficult procedure, and

the operation is not without danger for the wall of the sinus is quite thin. Roentgen therapy, in the hands of a capable radiologist, can do no harm in this condition.

I hope that this report will stimulate interest in radiation therapy of properly selected cases of the carotid sinus syndrome.

CONCLUSIONS

1. Five cases of carotid sinus syndrome are reported, in which roentgen therapy has been the sole specific treatment.
2. Roentgen therapy seems to afford definite prophylactic value in this small group.
3. No mention can be found in the literature of the use of roentgen therapy in this syndrome.

BIBLIOGRAPHY

- (1) BEALL, K. H., and JAGODA, S.: Irradiation of Sympathetic Ganglia: Valuable Therapeutic Procedure. *Texas St. Jour. Med.*, 26, 279, 280, August, 1930.
- (2) BLAKEMORE, A. H., HUMPHREYS, G. H., and KING, B. G.: Experimental Studies in Carotid-jugular Anastomosis, with Special Reference to Role of Carotid Sinus. *Ann. Surg.*, 105, 74-92, January, 1937.
- (3) BUCY, PAUL C.: Carotid Sinus Nerve in Man. *Arch. Int. Med.*, 58, 418-432, September, 1936.
- (4) CODE, C. F., and DINGLE, W. T.: Carotid Sinus Nerve. *Proc. Staff Meet., Mayo Clin.*, 10, 129-132, Feb. 27, 1935.
- (5) DOWNS, T. MCKEAN: The Carotid Sinus as an Etiological Factor in Sudden Anesthetic Death. *Ann. Surg.*, 99, 974-984, June, 1934.
- (6) FERRIS, E. B., JR., CAPPS, R. B., and WEISS, S.: Relation of Carotid Sinus to Autonomic Nervous System and Neuroses. *Arch. Neurol. and Psychiat.*, 37, 365-384, February, 1937.
- (7) KREMER, D. N., and LAPLACE, L. B.: Heart Block Following X-ray Treatment for Thyrotoxicosis. *Am. Heart Jour.*, 11, 227-232, February, 1936.
- (8) LANGER, HEINZ: Roentgen Treatment over Vegetative Nerve Centers of Ganglia in Diseases Presenting Symptoms of Disturbances of the Vegetative Nervous System. *Am. Jour. Roentgenol. and Rad. Ther.*, 28, 747-763, December, 1932.
- (9) LEWIS, T.: Vasovagal Syncope and Carotid Sinus Mechanism, with Comments on Gowers' and Nothnagel's Syndrome. *British Med. Jour.*, 1, 873-876, May 14, 1932.
- (10) MISSAL, M. E., and CRAIN, R. B.: Alternation Phenomena in the Electrocardiogram: Occurrence in Patient with Active Carotid Sinus Reflex. *Am. Heart Jour.*, 11, 611-618, May, 1936.
- (11) NATHANSON, M. H.: Further Observations on the Effect of Drugs on Induced Cardiac Standstill. *Arch. Int. Med.*, 54, 111-130, July, 1934.
- (12) PFAHLER, G. E.: Roentgen Therapy of Thrombo-angiitis Obliterans. *Am. Jour. Roentgenol. and Rad. Ther.*, 34, 770-777, December, 1935.

² In brief this law states that small doses of radiation stimulate tissue, moderate doses inhibit, and large doses destroy.

(13) SIGLER, L. H.: Clinical Observations on the Carotid Sinus Reflex. *Am. Jour. Med. Sci.*, 186, 110-128, July, 1933.

(14) Idem: Electrocardiographic Observations on Carotid Sinus Reflex. *Am. Heart Jour.*, 9, 782-791, August, 1934.

(15) Idem: Further Observations on Carotid Sinus Reflex. *Ann. Int. Med.*, 9, 1380-1392, April, 1936.

(16) SMITH, H. L., and MOERSCH, F. P.: Syncope of Patients with Hypersensitive Carotid Reflexes: Attacks Reproduced by Cardiac Standstill Induced by Pressure on Carotid Sinus. *Proc. Staff Meet., Mayo Clin.*, 10, 401-405, June 26, 1935.

(17) Idem: Further Study on the Hypersensitive

Carotid Sinus Reflex Syndrome. *Proc. Staff Meet., Mayo Clin.*, 11, 380-383, June 10, 1936.

(18) WEISS, SOMA, CAPPS, RICHARD B., FERRIS, E. B., JR., and MUNRO, DONALD: Syncope and Convulsions Due to a Hyperactive Carotid Sinus Reflex: Diagnosis and Treatment. *Arch. Int. Med.*, 58, 407-417, September, 1936.

(19) WILSON, DAVID C., and WARSON, ROBERT F.: Narcolepsy, with Special Reference to Carotid Sinus Reflex. *South. Med. Jour.*, 27, 754-759, September, 1934.

(20) WRIGHT, S.: Recent Work on Afferent Control of Circulation in Health and Disease. *British Med. Jour.*, 1, 457-462, March 12, 1932.

MEDIAN RHOMBOID GLOSSITIS

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THE total number of cases represented in this survey of the literature on the subject is 54. In addition, the lesion is briefly discussed in several textbooks on dermatology and some of the treatises on diseases of the mouth and tongue. (See bibliography 25 to 33, inclusive.)

Review of Literature.—In 1906, Brocq (1) first mentioned this interesting lesion in a brief paragraph, but it was not until 1914 that he and Pautrier described in detail 17 cases of "glossite losangique médiane de la face dorsale de la langue." Since then, several authors have contributed case reports, all crediting Brocq and Pautrier (2) with the distinction of being the first to recognize this lesion as a separate entity, not to be confused with lingual manifestations of syphilis, tuberculosis, or neoplasm.

Three months after Brocq and Pautrier's original contribution, Jourdanet (3) reported a single case and emphasized the importance of distinguishing this lesion from other lesions of the tongue. In his patient the lesion existed coincidentally with syphilis. In the same year Dubreuilh (4) reported two cases in syphilitics and stated that most of those who encountered the lesion thought it to be a manifestation of syphilis. The first patient came to Dubreuilh, in 1894, for the treatment of syphilis. The lesion did not respond to antisyphilitic therapy and 20 years later its appearance remained unchanged. The second patient asserted that the lesion had been present at least 12 years prior to its discovery by Dubreuilh and that it had not changed during that time. Balzer and Galliot (5) presented a patient with a peculiar X-shaped lesion of the tongue which Pautrier, in discussion, stated was not the type described by Brocq and himself. On the other hand, de Azua (6) described a typical lesion but called it tuberculosis.

Sanz de Grado (7) in 1916, Arndt (8) in 1921, Léorat (9) and May (10) in 1922, and Lane (11) in 1924, independently reported single cases. The two cases of "a hitherto undescribed condition of the tongue," reported by Fordyce and Cannon (12) shortly before Lane's report, probably were examples of the nodular form of the lesion. Siemens (13) described two cases associated with leukoplakia of the buccal mucosa. Barber (14) described a lesion similar to those of Fordyce and Cannon's patients. Ercoli (15) reported four characteristic examples of the lesion and raised the question of their being tuberculids.

Brocq (16) and Kraus (17) each reported single cases in 1927, and in 1928 Zimmerman (18) gave a complete review of the pre-existing literature on the subject. In addition, she described in detail a case that had been briefly presented by Zurhelle (19) two years before. Pautrier (20) also reported an additional case in 1929. Gougerot and Dechaume (21), in 1933, described smooth plaques in various portions of the tongue which they regarded as atypical forms of the lesion. A year later Abshier (22) reported an additional case. In 1934, Loos and Hörbst (23) described one of eight typical cases in detail. These authors made a significant contribution by proposing a theory of origin of the lesion based on a study of the embryology of the tongue. This will be considered later in this communication. Martin and Howe (24) recently added 11 more cases to the literature and corroborated Loos and Hörbst's theory of the etiology. A photograph of an additional case is shown in Prinz and Greenbaum's book (25).

Clinical Aspects of the Lesion.—The lesion is a localized lozenge-shaped, irregularly rhomboid, or oval area of the dorsal surface of the tongue. It is commonly located about one centimeter anterior to the V at the apex of the vallate

papillæ, but it may be found considerably further toward the tip of the tongue. The rosy surface is smooth and glistening due to a complete absence of papillæ. It may be dotted with a few nodules of pin-head size. The lesion may be composed of several confluent or rounded nodules or it may be subdivided by fissures into separate smooth-surfaced areas, the characteristic ovoid or rhomboid configuration of the lesion as a whole being preserved (Fig. 2). The dimensions vary from case to case. The long axis always lies in the septum linguæ and measures from one and one-half to three centimeters. The width varies between seven-tenths and one and one-half centimeters, and the surface may be elevated from two to five millimeters above the surrounding mucosa. The lesion is not only visibly demarcated sharply from its surroundings, but palpably also, for it is somewhat firm to the touch in comparison with the adjacent soft lingual tissue.

The lesion is typically asymptomatic and it is usually discovered by chance. In some of the reports, however, it is stated that a vague sensation or sharp pain brought it to the attention of the patient. From a study of the cases in the literature in which the sex of the patient was specifically recorded, it is found that the lesion is approximately three times more often in males than in females. The lesion has never been described in an infant. Indeed, the youngest patient reported (Case 2, of Brocq and Pautrier, 2) was 15 years old. One patient, however, stated that she had had the lesion "as far back as she could remember" (the author's Case 1). Although only 54 cases have been reported in the literature, Arndt (8) stated that in a period of 18 months 40 examples of this lesion were observed in the Berlin University Skin Clinic. If patients' tongues were routinely carefully inspected, the lesion might be encountered more often.

Microscopic Characteristics.—The epithelium is devoid of the papillæ ordinarily present in the portion of the tongue occupied by the lesion. There may be considerable hornification of the surface lay-

ers, and the cells of the Malpighian layer tend to proliferate downward, forming elongated pegs in the connective tissue. These may branch and anastomose in an epithelial rete. Mitotic figures are absent. The tunica propria is sometimes infiltrated with lymphocytes (Fig. 2-A). This infiltrate is most abundant near the epithelium, where there is also an increase in collagenous connective tissue. Blood vessels and lymphatics are numerous, forming extensive capillary networks in the tunica propria. In some cases there is degeneration and hyalin formation in the striated musculature of the tongue (Fig. 2-B). These are the changes ordinarily present in a chronic inflammatory lesion.

Etiologic Considerations.—The etiology of this lesion is unknown. More than half of the cases described in the literature had no associated disease. Syphilis, the use of tobacco, and poor oral hygiene are probably not factors in its causation since leukoplakia, a frequent concomitant of intra-oral irritation, is notably a rare finding, being associated with the lesion in only two of the cases of Brocq and Pautrier (2) and in the two cases reported by Siemens (13). A history of syphilis or a positive serologic reaction is frequent in the cases reported by the French authors (2, 3, and 4), but they emphasize that the lesion is merely a coincidental finding and that it is entirely resistant to antisiphilitic therapy. Lupus erythematosus was present in Case 11 of Brocq and Pautrier (2). Ercoli (15) thought the lesion might be a tubercle, but presented no convincing evidence to support this theory. None of the cases investigated by the author or by others showed tuberculous or neoplastic characteristics, but microscopic evidence of chronic inflammation is invariably present. Loos and Hörbst (23) interpreted the presence of dilated lymphatics and capillaries as meaning that the lesion was an angioma. These authors and Martin and Howe (24) have attempted to link the lesion with an anomalous persistence of the tuberculum impar. In order to consider this aspect of the etiology it is neces-

sary to turn briefly to the embryology of the human tongue.

According to the textbooks of embryology, the epithelium of the free portion, or body of the tongue, is derived from the

midline somewhere anterior to the apex of the *V* of the vallate papillæ which anatomically separate the body of the tongue from the root. Although this is only *a priori* evidence for the etiology of this in-

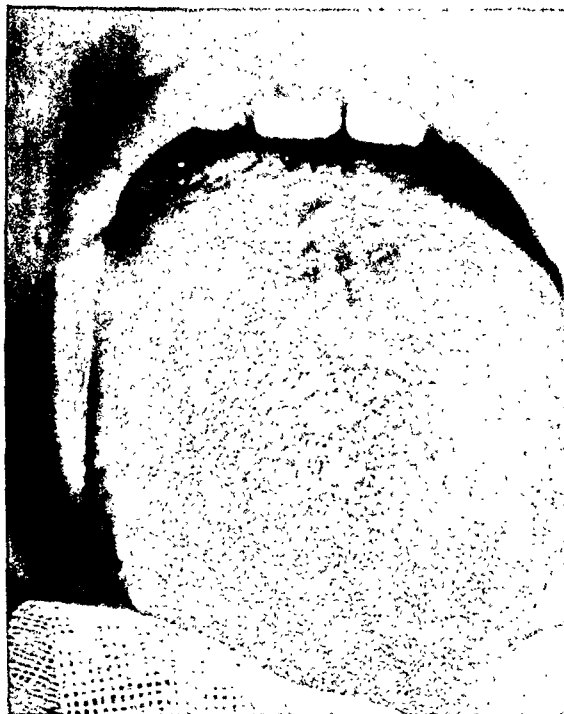


Fig. 1. Case 1.



Fig. 2. Case 2.

paired lateral swellings of the first or mandibular arch. The anlage of the epithelium of the root of the tongue is the copula or "yoke" between the second branchial arches. Between the lateral mandibular swellings in a human embryo of 5 mm. there is a rhomboid depression. From this the tuberculum impar (unpaired tubercle) of His projects dorsally (Fig. 4). Formerly, this was thought to be the chief anlage of the body of the tongue, but in 1901 Hammar (34) stated that it is merely a transitory structure and takes no part in the formation of the human tongue.

Whether or not the tuberculum impar does persist as a part of the adult tongue, it is conceivable that a rhomboid or oval anomaly might be derived from it. Such an anomaly would be likely to lie in the

teresting lesion, it constitutes a plausible clue to its origin. If the lesion should ever be discovered on the tongue of a premature fetus or a newborn infant, there could be little doubt about its development as a prenatal anomaly.

Diagnosis and Treatment.—The lesion may be recognized from (1) its characteristic location in the median raphe of the dorsum of the tongue, anterior to the vallate papillæ; (2) its roughly rhomboid shape; (3) its rosy color; (4) its smooth, nodular, or fissured surface completely free of papillæ; (5) its slight induration, and (6) its asymptomatic character and chance discovery.

If no symptoms are attributable to it, treatment is not indicated, for it is certainly a benign condition. However, if

it is associated with annoying symptoms, if it gives rise to cancerphobia, or if there is reasonable doubt concerning the diagnosis, excision is advisable. As far as the writer could ascertain, no reports have been made

negative. No biopsy was taken. The author saw the patient two years later, several months after the termination of a normal pregnancy. The lesion had not changed.

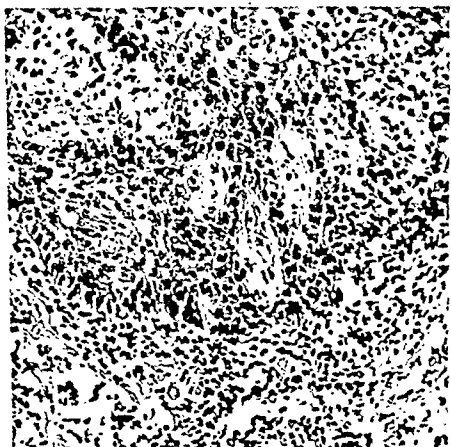


Fig. 2-A.

Fig. 2-A. Photomicrograph from Case 2 showing lymphocytic infiltration of tunica propria and epithelium. (Hematoxylin and eosin.)

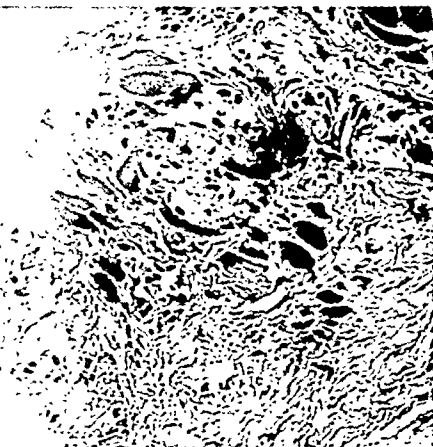


Fig. 2-B.

Fig. 2-B. Photomicrograph from Case 2 showing muscle degeneration and hyalinization. (Hematalum, erythrosin, and saffron.)

of the effect of radium or x-ray therapy on the lesion.

CASE REPORTS

Case 1. B. W. M., white nurse, 21 years of age, consulted the author in March, 1936, regarding a lesion on her tongue which had been present "as far back as she could remember." It had never increased in size, nor had it ever produced symptoms. No member of her family had a similar lesion. She smoked moderately, but she was certain that the lesion had been present many years before she began to smoke.

Examination showed a rosy-red superficial lesion of hexagonal contour on the dorsal surface of the tongue, 1 cm. anterior to the lingual V (Fig. 1). It was elevated about one millimeter above the surrounding mucous membrane and was firmer than the adjacent normal lingual structures. Its surface was smooth and glistening and its edges were clear-cut. The long axis lay in the midline of the tongue. The dimensions were 1.8 cm. \times 1.3 cm. The Wassermann and Kahn reactions were

Case 2. B. G., white male, 60 years of age, a native of Czechoslovakia, was seen in the out-patient department of the University of Chicago Clinics in April, 1938, because of a chest complaint. During an E.N.T. examination a hard lesion on the dorsal surface of the tongue was discovered (Fig. 2). It was 3 cm. long \times 2.2 cm. wide, had an ovoid shape and a reddish hue, and its long axis lay in the midline of the tongue. It was composed of broad smooth-surfaced elevations from 2 to 3 mm. in height. These were separated by deep transverse fissures. The teeth were carious. The patient denied ever having had syphilis and the serological tests were negative. He had never before been aware of the existence of the lesion. The Wassermann and Kahn reactions were negative.

A biopsy specimen showed a hyperplastic epithelium without evidence of mitotic activity. There was a heavy lymphocytic infiltration. The lymphocytes were most abundant in the lower epithelial layers and in the tunica propria immediately beneath the epithelium (Fig. 2-A). Special

stain revealed degenerative changes in the muscle fibers of the tongue (Fig. 2-B).

Case 3. G. V. R., white male, 39 years of age, complaining of impaired hearing, was seen in the E.N.T. Department of the

V. No biopsy was taken. The Wassermann and Kahn reactions were negative.

COMMENTS AND CONCLUSIONS

The origin of this lesion still remains a



Fig. 3.

Fig. 3. Case 3.

Fig. 4. Stage of development of tongue in 5 mm. human embryo (from Kollman's Atlas). A. The tuberculum impar. B. The copula. UK, II, III, and IV. First four branchial arches.

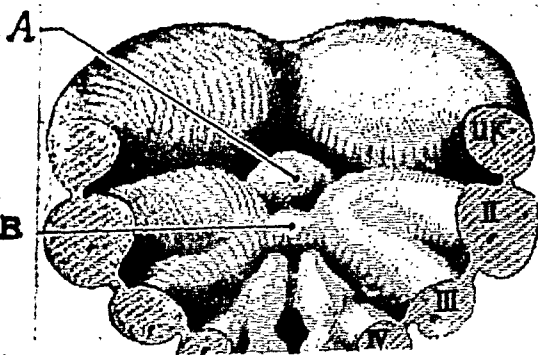


Fig. 4.

University of Chicago Clinics in June, 1938. He was found to have a chronic suppurative otitis media and a typical rhomboid lesion of the tongue. The patient had no previous knowledge of the presence of this lesion.

Examination revealed a reddish, smooth, diamond-shaped, slightly indurated area on the dorsum of the tongue, 1.5 cm. anterior to the lingual V. It was elevated 1 mm. and measured 3 cm. \times 1.5 cm. with the long axis in the midline of the tongue (Fig. 3). The teeth were in fair condition and the Wassermann and Kahn reactions were negative. The patient smoked moderately. No biopsy was taken.

Case 4. P. Z., white male, 44 years of age, was examined in June, 1938, in the E.N.T. Department of the University of Chicago Clinics because of an external otitis. During the examination a lesion was discovered on his tongue, of which he had previously been unaware. It was in all respects like that of Case 3 except that it was slightly smaller, measuring 2 cm. \times 1.4 cm. It lay just anterior to the lingual

source of speculation. Clinically, it is a benign process, but microscopically it has the characteristics of a mild chronic inflammation. Although there is good reason to infer from a study of the embryology of the tongue that the lesion arises as a developmental anomaly of the epithelium—perhaps from the tuberculum impar—there is no direct proof of this.

Brocq and Pautrier's original descriptive title of the lesion is rather ponderous. It is probably better called (after Lane, 11) "glossitis rhombica mediana" or the English counterpart "median rhomboid glossitis." This title has the advantage of being descriptive without being unwieldy. Cutler (35) calls the lesion "papilloma durum."

The lesion is not a common one, but it is probably less rare than is supposed. Its lack of symptoms and its location quite far back on the tongue undoubtedly account for its being overlooked frequently. It is important to recognize this lesion as a process distinct from syphilis, tuberculosis, and malignancy with which it has been occasionally confused.

BIBLIOGRAPHY

- (1) BROcq, L.: *Traite Elementaire de Dermatologie Pratique*, 1, 522, 1907. G. Doin, Paris.
- (2) BROcq, L., and PAUTRIER, L. M.: *Ann. de dermat. et syph.*, 5, 1, 1914.
- (3) JOURDANET, P.: *Lyon méd.*, 123, 103, 1914.
- (4) DUBREUILH, W.: *Ann. de dermat. et syph.*, 5, 615, 1914, 1915.
- (5) BALZER, F., and GALLIOT, H.: *Bull. Soc. franç. de dermat. et syph.*, 25, 213, 1914.
- (6) DE AZUA, J.: *Dermat. Wehnschr.*, 21, 503, 1915.
- (7) SANZ DE GRADO, J.: *Dermat. Wehnschr.*, 28, 682, 1916.
- (8) ARNDT, G.: *Zentralbl. f. Haut-u. Geschlechtskr.*, 3, 341, 1922.
- (9) LÉORAT, L.: *Lyon méd.*, 131, 911, 1922.
- (10) MAY, J.: *An. Fac. de med.*, Montevideo, 7, 219, 1922.
- (11) LANE, J. E.: *Arch. Dermat. and Syph.*, 9, 547, 1924.
- (12) FORDYCE, J. H., and CANNON, A. B.: *Arch. Dermat. and Syph.*, 8, 749-753, December, 1923.
- (13) SIEMENS: *Zentralbl. f. Haut-u. Geschlechtskr.*, 8, 233, 1923.
- (14) BARBER, H. W.: *Proc. Roy. Soc. Med.*, 6, 39, 1924.
- (15) ERCOLI, O.: *Gior. ital. di dermat. e sifil.*, 67, 800, 1926.
- (16) BROcq, L.: *Clin. Dermat.*, Second series, p. 551, 1927.
- (17) KRAUS, A.: *Zentralbl. f. Haut-u. Geschlechtskr.*, 22, 843, 1927.
- (18) ZIMMERMAN, C.: *Dermat. Ztschr.*, 54, 168, 1928.
- (19) ZURHELLE, E.: *Arch. f. Dermat. u. Syph.*, 155, 321, 1927.
- (20) PAUTRIER, L. M.: *Bull. Soc. franç. de dermat. et syph.*, 36, 1152, 1929.
- (21) GOUGEROT, H., and DECHAUME, M.: *Ann. d. mal. ven.*, 28, 801, 1933.
- (22) ABSHIER, A. B.: *Arch. Dermat. and Syph.*, 30, 409, 1934.
- (23) LOOS, H. O., and HÖRST, L.: *Arch. f. Ohren-, Nasen- u. Kehlkopfh.*, 138, 122, 1934.
- (24) MARTIN, H. E., and HOWE, M. E.: *Ann. Surg.*, 107, 39, 1938.
- (25) PRINZ, HERMANN, and GREENBAUM, SIGMUND S.: *Diseases of the Mouth and Their Treatment*. Lea and Febiger, Philadelphia, 1935.
- (26) DARIER, J.: *Précis de Dermat.* Masson et Cie, 1918.
- (27) MIKULICZ, J., and KUMMEL, W.: *Die Krankheiten des mundes*. Third edition, Jena, 1922.
- (28) ANDREWS, GEORGE CLINTON: *Diseases of the Skin*. W. B. Saunders Co., Philadelphia, 1930.
- (29) ZINNser, F.: *Handb. d. Haut-u. Geschlechtskr.*, Vol. 14, first part, Julius Springer, Berlin, 1930.
- (30) SEBILEAU, PIERRE: *Cancer de la langue*. G. Doin et Cie, Paris, 1932.
- (31) BUNNING, C.: *Arch. f. Ohren-, Nasen- u. Kehlkopfh.*, 133, 103, 1922.
- (32) SUTTON, RICHARD, and SUTTON, RICHARD, JR.: *Diseases of the Skin*. Ninth edition revised. C. V. Mosby and Co., St. Louis, 1935.
- (33) ORMSBY, OLIVER S.: *Diseases of the Skin*. Fifth edition, Lea and Febiger, Philadelphia, 1937.
- (34) HAMMAR, J. A.: *Anat. Anz.*, 19, 570, 1901.
- (35) CUTLER, M., and BUSCHKE, F.: *Cancer: Its Diagnosis and Treatment*. W. B. Saunders Co., Philadelphia, 1938.

THE VALUE OF ASSESSING AND PRESCRIBING DOSAGE IN RADIATION THERAPY IN SIMPLE TERMS¹

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THE evolution of radiotherapy has been so rapid that progress is now being hindered by methods of prescribing and of reporting dosage which are obsolete, and should be discarded. In the earlier stages, really accurate knowledge of that one essential, the amount of radiation absorbed, was lacking, and for years it was necessary to define technic by describing in detail all the variable factors. During the transition period such details could not be omitted, but I feel that they now confuse rather than assist clear thinking. If comparison of method is to be worth while, and further progress is to be made, all the variables must be summated into a statement which gives only the essential primary factors. These I believe to be:

- (1) *Dose*, or quantity of radiation absorbed;
- (2) *Quality*, or wave length of radiation, and
- (3) *Time*, or duration of treatment.

Adequately expressed, these three factors give all the necessary information. The second factor, quality, must always be described separately, and there are recognized methods of measuring wave length which I do not intend to discuss here. The first and third factors are so closely connected that they cannot be separated. Therefore, although this article deals with the first and more important—dosage—certain comments concerning the time factor are necessarily included.

A paper such as this is an expression of personal opinion, and as such may appear to be dogmatic. I am well aware that controversial issues are being ignored, but it is worth an effort to go straight through the difficulties to what I believe to be the

fundamental facts regarding the dose absorbed. I am, therefore, sub-dividing and dealing in the first section with:

- (1) General principles relating to all forms of radiation;
- (2) X-ray dosage, and
- (3) Radium dosage.

In the second section, at the risk of appearing over-critical, I am enumerating under the following headings certain methods of recording dosage which I believe should be discarded:

- (4) Roentgens in air;
- (5) Erythema dose;
- (6) Summated roentgens to skin fields;
- (7) Ergs and I-Mc;
- (8) Radium erythema dose;
- (9) Millicurie-hours, and millicuries destroyed.

Finally, as Section 10, I will try to illustrate the value of what I believe to be the most satisfactory method of prescribing and recording dosage of radiation.

(1) *General Principles*.—The essential features of any valid method of dosage computation include as a first necessity the possibility of expressing the dose in terms of amount of radiation without reference to the changes produced. When a drug is under consideration, a dose is a quantity, not an effect; thereafter, the various effects are studied in relation to variation of dosage. Inevitably, because it has already gained international acceptance, that quantity in radiation therapy has to be given in roentgens. The roentgen itself is a simple physical concept of an amount of radiation, about which there is little argument. Problems begin to arise only when we come to develop methods of measuring roentgens for our purposes. Clinical dosage must be stated in terms of the tissue dose; in the treatment of ordinary malignant dis-

¹ Read before the Society of Radiotherapists of Great Britain and Ireland, March 18, 1938.

ease the only tissues which have to be considered are tumor and skin. Two things, and two things only, have real importance; the dose at the tumor and the dose at the skin which has to be irradiated during treatment. The dosage system must determine the dose actually received at every point in a tumor, usually by stating maximum and minimum doses. Computation of dose to the skin should be thought of in terms of the dose delivered at that point, in the area irradiated, which receives the highest dose.

In actual clinical work, however, a statement of mere quantity is itself inadequate. The duration of exposure has a profound influence on the effects produced. Thus any consideration of the correct dose to be given to produce a particular effect requires that a statement be made of the time over which that dose is spread, *i.e.*, overall time. Reinhart, Quimby, and previously, Kingery have tried, and are trying, to devise methods of combining these two, dose and time, under one concept—the “cumulative” dose. At the moment, however, the experimental foundations of these theories are inadequate, and I, at least, feel that we should for the present state “dosage in relation to time”—for example, 6,000 r in eight days, 2,250 r in one hour, 10,000 r in ten weeks, and so on.

The possibility of stating skin and tumor dose categorically in the manner suggested is often questioned, but the difficulty can be overcome. The physicists have not yet solved all the problems involved in applying this rather curious r unit to our purposes. The chief problem which arises is that roentgens are not automatically a direct index of energy absorbed. It would seem that radiation effect is directly related to energy absorbed, and thus effect may not necessarily run parallel to dosage in roentgens under all conditions of absorption and wave length. This is particularly true in relation to the absorption in skin and bone. In spite of the unsolved physical problems, the physicists have obtained information accurate enough to allow progress, and the uncertainty in this respect

should not detract from the real value of that which has already been clearly demonstrated.

The methods of assessing quantity of x-radiation and quantity of gamma-radiation are different, and require separate consideration.

(2) *X-ray Dosage*.—In x-radiation the first process in any calculation is to assess the true surface dosage at each field. This can be arrived at in two distinct ways, both of which are useful. The first is to measure once and for all for certain plant output rates in air, the dose delivered at the body surface, using applicators of various sizes, or by the radiation of fields of various areas. This is usually done by previous measurement in wax or water phantoms, using the applicators likely to be employed in the department. An attempt is then made by means of bolus bags, rice bags, and other methods of building up the volume, to duplicate the phantom conditions during actual treatment.

The alternative method is to measure this surface dose directly at the skin itself by means of an integrating dosimeter placed on the skin.

Both of these are perfectly valid methods, but both have difficulties, and require that certain precautions be very strictly observed. In the water or wax phantom method, it is essential to be very thorough with back-scattering media, or to make allowance for differences from the original conditions of measurement, as is done for instance, by Quimby's correction curves for radiation in lung, etc. Moreover, there must be some way in which the plant output rate can be reasonably maintained, as this is not being measured during treatment. Using the integrating dosimeter method, the readings made are only strictly valid if the dosimeter is dead in the center of the beam, and half countersunk into skin. Such conditions are by no means adequately observed, or, in many cases, even attempted. As a result, the latter method, though theoretically perfect, may be very risky. Of the two the first is, I think, to be preferred, unless there are

special departmental reasons to the contrary.

Both of these methods will measure the actual dose in roentgens which has been received by the skin. It is redundant, therefore, to talk of this measurement as "dose with back-scatter," since scattered radiation has to be included in order to measure the unknown—the dose at a surface. It is not possible to measure a dose absorbed at a body surface without back-scatter.

Tumor dose is arrived at in terms of percentage depth dose: That is to say, by the use of charts showing the fraction of the surface dose which will be absorbed at that depth at which the tumor is, by various devices, assessed to lie. For the kilovoltages in use to-day, such percentage depth dose charts already exist in a variety of forms. For the new supervoltage installations, before quantity of radiation reaching a tumor can be assessed, new depth dose charts will have to be constructed. In single-field treatments the tumor dose is usually stated in terms of dose at the center of the tumor; in crossed-field techniques, dose is the sum of all contributions received from various fields. If correctly arrived at, this sum states directly in roentgens the amount of radiation received by the tumor. Actually, insofar as the assessment is made at the point where the centers of the various beams cross, the maximum dose in the tumor zone, rather than the minimum, is usually being stated.

Skin dose, in the case of a single field treatment, is the surface dose as already described. In the case of multiple fields, however, each area of skin may also receive contributions through the body from other fields. The amount of such contributions must be calculated by the use of depth dose graphs as in the assessment of tumor dose. The true skin dose is the sum of the incident surface dose plus such contributions. I think it will be agreed that this is the only measure of the total amount of radiation received at any point in that particular area of skin concerned.

To bring this question of x-ray dosage

into focus, the bare essentials of an x-ray prescription may be shown by one example (Fig. 1).

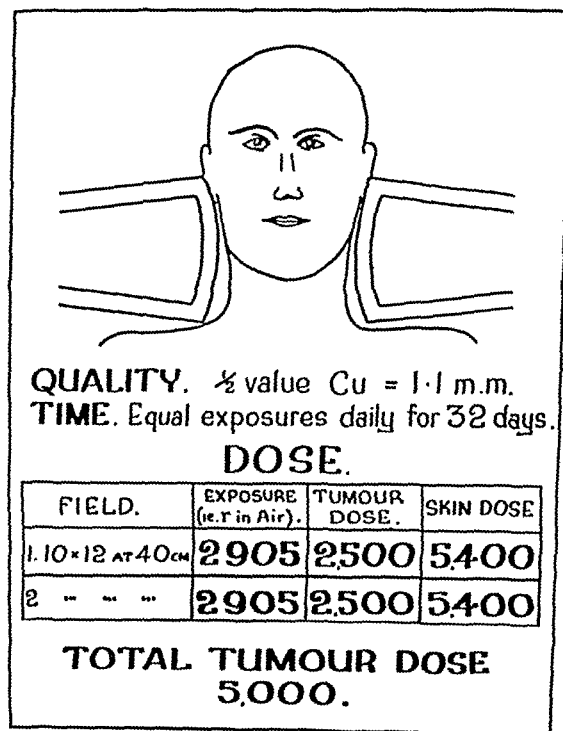


Fig. 1.

(3) *Radium Dosage.*—Radium dosage assessment is in one sense simpler, in another more complex, than x-ray. It is simpler in that the source of radiation is very constant, and because of this constancy we can devise methods for assessing the dosage at any point at a known distance from any arrangement in space of radio-active foci. It is then accepted that when the point lies in tissue, the same dose will be absorbed. This occurs in ordinary radium work because with the volumes implanted and the areas of skin usually irradiated, the effects of scatter in the case of gamma rays approximately neutralize the loss from absorption. Thus the dose assessed in air and the dose absorbed in tissue are identical. The radium collar and the bomb are slight exceptions to this generalization.

The radium problem is complex in that the dose has, by some means or other, to be assessed at a variety of points, and often from a large number of radio-active foci.

Further, if the international roentgen is to be adopted as the unit of radiation, it has to be assessed in roentgens. I think by a combination of mathematical and physical means, sufficiently useful methods of assessing dosage can be devised, even in very complex arrangements of radio-active foci. This was first achieved satisfactorily in terms of ergs per cubic centimeter by Murdoch and Stahel. In articles published by Parker and the writer² simpler dosage systems for both superficial radium therapy and for interstitial work are outlined. These methods are intended to provide a satisfactory method of prescribing in terms of amount of gamma-radiation absorbed, and to avoid the cumbersome statement of detail by considering milligram hours as a dosage system.

The evaluation of the gamma-ray intensity at one centimeter from one milligram of radium has proved a physical problem difficult to solve, but the various investigators whose work can be accepted are now very close indeed to agreement, and the roentgen can be legitimately used for gamma-ray measurement. Parker, in 1932, evaluating from Gray's experiments, used 8.4 as the basis of our dosage graphs and I see no indications for departing from that value.

This is a very abbreviated presentation of one approach to the dosage problem, and it may clarify the position to contrast with this certain other commonly used methods purporting to indicate dosage, to try to find out what they really indicate, and to assess what information they yield.

(4) *Roentgens in Air*.—The first and most important practice which I should like to see abolished is *r* in air. This is a measure of the intensity of an x-ray beam at a certain distance from the target, but it is not in any sense a measure of a dose absorbed. When the statement is made that an area of skin has had a dose of 300 *r* in air, the information really conveyed is that this area has been exposed to a beam of known intensity for a period of time. If

the statement is further qualified by noting the size of the field, the wave length, and the portion of the body irradiated, an estimate of the actual dose received by that skin is possible to those with experience, but the statement of the conditions cannot be omitted. *R* in air for x-ray is rather like milligram-hours in radium—it has a limited value in describing a technic which it is desired to duplicate, but no value in stating or prescribing dosage.

Criticism of the definite acceptance of tissue dose, whether on the surface or deep, as an entity is almost always founded on the plea that by international definition, the roentgen has to be measured in air. Since the International Units Committee approved the new definition of the roentgen, the whole idea is modified. All that the international definition requires is that the radiation being absorbed at any point be estimated by the amount of ionization produced in a tiny air-filled cavity at that point. In Figure 2 situation *A* is that in which measurement of radiation is made in air, in that the air-filled cavity is surrounded by air. The measurement is, therefore, one of the intensity of the beam. In *B* the air-filled cavity is on a surface (tissue or water) and, therefore, the ionization measured in the air of the cavity is a measure of the radiation being absorbed at that surface. In *C* we have a situation giving a true measure of the dose in tissue. The radiation is being assessed by ionization in air, *i.e.*, in the air-filled cavity, as required by the definition, but in terms of real tissue dose.

Summarizing, therefore, *r* in air is a measure of the intensity of a beam of radiation, and therefore a method of measuring and stating tube output, but it does not measure dose.

(5) *Erythema Dose*.—In the early days of radiation therapy, the erythema dose as a measure of a quantity of radiation served a real purpose. At the time of its development, ionization chambers were weird and wonderful, but scarcely accurate. Chemical and photographic methods were very crude, and the most accurate way of

² British Jour. Radiol., 7, October, 1934, and British Jour. Radiol., 11, May, 1938.

assessing an amount of radiation was to find the exposure necessary to produce a certain defined type of erythema under

abolished is the habit of stating the skin dose as the sum of all the skin doses to various fields. For example, in a four-field

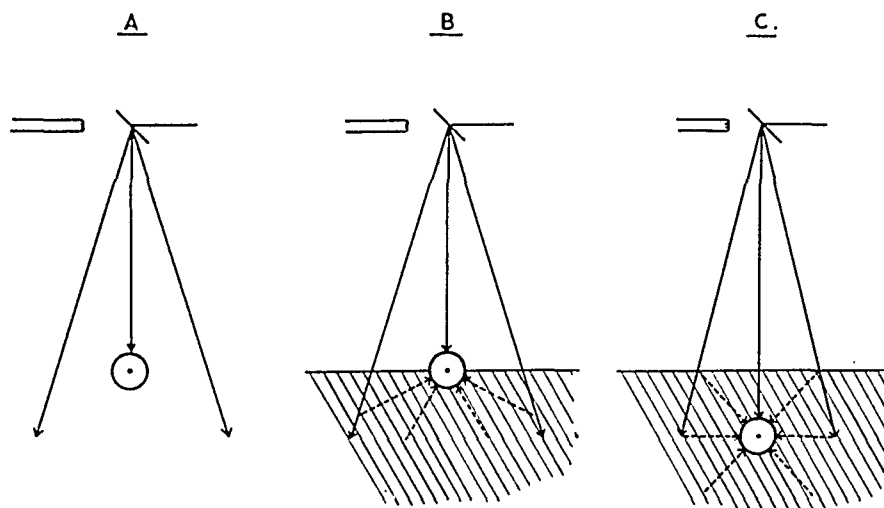


Fig. 2.

given, conditions, and then to give fractions or multiples of this amount under the same or similar conditions. It is essential to note that even at this stage this was merely a crude method of measuring an amount of radiation, a method identical in principle with other biologic assays, for example, the older methods of assaying diphtheria antitoxins or vitamin values. The patient was being used temporarily as an experimental animal.

The erythema dose had a right to survive only so long as there were no better instruments for measuring quantity of radiation. This lack has been filled by the modern ionization chamber. In actual practice to-day, the so-called erythema dose is found to mean little more than a fixed period of exposure at certain fixed plant factors, and I wonder how many centers would have to go back several months or even years to their last assessment of the E.S.D. or H.E.D., by the production of a standard erythema according to definition.

(6) *Summated r to Skin Fields.*—The third practice which I should like to see

technic in which each field gets 5,000 r, the skin is described as having had 20,000 r.

I feel that a statement to the effect that a dose of 20,000 r to skin had been given ought to provoke the immediate question: how was the resultant necrosis dealt with? The anomaly may perhaps be best illustrated in this way: if the abdomen is exposed to four contiguous fields, each 5×5 , and given 3,000 r through each, the dose using this summated r to skin method of prescription will be described as 12,000 r; but if the same area is exposed to a single field of 20×20 , then as far as the skin is concerned, exactly the same dose has been given, and yet now the given dose can only be called 3,000 r. Probably the general idea underlying the custom is, that if all these fields are aiming at the same point, for instance at the cervix, with a 30 per cent depth dose, then that cervix will have received 30 per cent of 12,000 r. But how much easier to go straight to the information wanted, and define the dose to the cervix as 3,600 r.

(7) *Ergs and Intensity Millicurie.*—Radium dosage raises other ideas, the most

important being the ergs/c.c. of Murdoch, and Sieverts' intensity-millicurie. These are real dosage units, and there is nothing to be said against them in principle. It just so happens that, rightly or wrongly, the roentgen has been chosen as the gamma-ray unit for therapy, and for convenience a majority decision must be accepted. Real measurement in ergs would have had, in fact, certain advantages. Before perfect assessment of radiation effects becomes possible, particularly in regard to the contrast of wave lengths on different tissues, dose will have to be measured in actual energy absorbed, for which the erg is the unit. A practical method of doing this, however, has not yet been found by the physicists.

(8) *Radium Erythema Dose.*—The threshold erythema dose like the x-ray erythema dose, has served its purpose, and it is reasonable to expect it now to be expressed in the accepted unit, the roentgen. To say so at this stage is in no way to decry the real contribution to radiotherapy made at the Memorial Hospital through their threshold erythema dose. I think the first really adequate attempts to determine tumor lethal dose quantitatively were made there, using that unit. If I read their publications correctly, that unit is now so linked to statistical and physical factors as to admit re-assessment of the threshold erythema dose at some figure a little under 1,000 r, the actual figure varying slightly with the medium employed, gold seeds, needles, or plaques, but I think within narrow limits.

(9) *Milligram-hours, and Millicuries Destroyed.*—It seems incredible that this unit should still be looked upon as a dosage unit, as milligrams bear exactly the same relationship to radium dosage as milliamperes, taken alone without any description of voltage, distance, etc., bear to x-ray dosage. The inadequacy of the present all too common custom of stating radium dosage in milligram-hours or in millicuries destroyed is best illustrated by considering how little information would be yielded by describing an x-ray treatment as having

given a dose of x milliampere-minutes. Milligram-hours is only one of the many factors in a treatment, and to convey information all the other factors must be known—filtration, spacing, distance, etc. Even where all the factors are stated perfectly, it is practically impossible to gather any real idea of the dose given. Hence, as in x-ray dosimetry, it has become essential to devise methods such that all the variables are summated into one single statement of the dose in roentgens at the point under consideration.

CONCLUSIONS

In conclusion, may I try to illustrate much of what I have been attempting to say by giving examples of the kind of information we hope to be able to gain by a more simplified statement of our treatment figures. Here are three statements:

- (1) 4,750 r in eight days is a lethal dose to 80 per cent of squamous-cell carcinomas;
- (2) 8,000 r in ten weeks is a sub-lethal dose to the majority of squamous-cell carcinomas;
- (3) Skin tolerance, for a small area, ranges from just under 3,000 r in one hour, to well over 10,000 r in ten weeks.

Please do not direct attention to the truth or otherwise of the actual statements made. I think all three statements are true, or at least not far off the truth, that is why they were chosen. The point I am anxious to make is not the truth of, but the need for, and possibility of, such statement. All three are abstract generalizations and quite detached from any questions of technic, such as site, wave length, etc. They are in a sense, almost academic. I feel that one of the great needs of present-day therapy is to build up our conceptions of dosage measurement in such a way that information can be gradually accumulated to develop such general information, and I

should like, therefore, to use these three statements as a guide to the evaluation of the best way of connoting and describing dosage. If a dosage system can be used to develop such generalizations, it passes; if it fails to do so, it must be discarded as of little value.

The value of thinking and prescribing in

the literal sense of the word *i. e.*, prescribing the real dosage to tumor and skin is unquestionable. Once the habit is acquired the difficulties of the old method are forgotten. Put shortly, tumor dose is thought of first, skin dose next, and last of all the technic by which the dose will be delivered.

POINTS OF INTEREST

It is the purpose of the Inter-Society Committee for Radiology to promote the benefits to be derived from organized activity. Among other things the Committee encourages the formation of local, regional, and state societies of radiologists. Not only should these carry on the usual scientific programs, but they should take active and constant interest in the economic and social problems of radiology in their locality. Unethical practices by hospitals and their own members are questions deserving the attention of these local groups. The prevention of illegal practice by laymen, below-standard practice in eleemosynary institutions, exploitation and competition by hospitals and other corporations, the ethical promotion of early diagnosis and preventive medicine—all these are proper subjects for local action. Wherever possible, organized effort on the part of radiological groups should be carried on under the aegis and through the machinery of the county and state medical societies.

Among the news items in this month's Bulletin, the Inter-Society Committee calls attention to a few of the interesting developments and desirable projects by local and state radiological societies in various sections of the country.

* * *

Alert members of the *Pacific Roentgen Club* continue a winning battle to protect radiology against domination by corporate agencies and third parties in new economic experiments for medical care. The Medical Service Plan, adopted by the California Medical Association on Dec. 18, 1938, provides for pre-payment under an insurance plan to be supervised by the medical profession. Complete medical and hospital care is provided. Radiological bills are paid along with other medical bills and hospital care is defined as consisting of those non-medical services which a hospital is legally qualified to give, *viz.*, bed, nursing, drugs, physiotherapy, and material appliances.

Efforts are being made to correct the recently inaugurated San Francisco Municipal Employees Health Service System which now includes an allowance for diagnostic medical

procedures in its *per diem* payment to hospitals for hospitalized illnesses. Vigilance has not been relaxed in regard to the several hospital care insurance plans which, due to the efforts of the Club's officers, have agreed to confine their benefits to hospital services alone.

New rates for malpractice insurance imposed by the Insurance Commissioner of California will more than double the premium now paid by California members of the Radiological Society of North America and the American Roentgen Ray Society under their blanket agreement with Lloyds of London. These members are still endeavoring to secure an agreement that will permit them to retain their preferred rating.

The twenty-fourth issue of the *Bulletin of the Pacific Roentgen Club*, now a semi-annual publication, was issued last month.

* * *

Reports reaching the Inter-Society Committee are that the *Medical Society of West Virginia* has approved the adoption of hospital insurance plans, with the provision that benefits are to be defined by local county medical societies. It is presumed that county societies will follow the principle enunciated by the American Medical Association, requiring that no medical services be included as part of hospital care.

* * *

The secretary of the *Michigan State Medical Society* recently spent several days in the Inter-Society Committee offices for the purpose of discussing a proposed hospital insurance plan to be directed by the state society. Hospitals in Detroit have created a plan of their own. Radiology is not included as a hospital benefit.

* * *

Nearly every state medical association in the country is investigating the desirability of perfecting a non-profit insurance plan for the pre-payment of medical bills for low income patients. *North Carolina* is not excluded. Radiologists there report that the proposed plan will reimburse policy holders for services received from radiological specialists in the

same manner that other medical and surgical benefits are provided.

An interesting fiscal arrangement for hospital practice has been accepted by radiologists working in one Asheville hospital. In the case of charity patients, the physicians contribute their services and the hospital contributes supplies and the use of its equipment. Pay patients receive a bill for all radiological charges on the physician's bill-head. Collections are held in trust by the hospital cashier. All receipts are turned over to the radiologists, who reimburse the hospital for expenses incurred in maintaining the department on an arbitrary basis of two dollars for each film used on a private patient.

* * *

The Council of the *Illinois Medical Society* has adopted a resolution that was distributed by the Inter-Society Committee last year to its list of state representatives. The resolution clarifies certain principles pertaining to the relationships between physicians and hospitals. Among other things it demands that, "No hospital shall offer, for a price, any medical service." The same resolution has been adopted by the Wyandotte County Medical Society (Kansas), the Hillsborough County Medical Society (Florida). It has been approved in modified form by several other county and state societies. Interested members may receive copies of the complete resolution by writing to the Inter-Society Committee office.

* * *

The *Nebraska Radiological Society* prepared a resolution, which was introduced at the last annual meeting of the state society, calling upon the society to affirm the action of the A.M.A. in regard to relations between hospitals and radiologists. It resolved that all services connected with the practice of radiology should be under the direct control and supervision of the medical profession. At the request of the Radiological Society, the Omaha-Douglas County Society has forbidden the inclusion of radiology as part of hospital care in a proposed hospital insurance plan.

* * *

In addition to its annual scientific conference in the Summer, the *Denver Radiological Club* maintains an active interest in the economic problems of radiology. Members were successful last year in defeating attempts by

local hospitals to include radiological services as a part of their care in a hospital insurance plan. The Colorado State Medical Society was brilliantly successful in defeating a bold attempt by chiropractors to amend the State Constitution in such a manner as to permit them to engage in medical diagnosis and treatment. The amendment was overwhelmingly defeated in the last state election.

* * *

Radiological practice will benefit from two decisions recently made by organized medicine in *Oregon*. A special committee has been appointed by the state society to make an investigation and recommendations relative to the status of radiologists and pathologists in hospitals in connection with a medical insurance plan to be operated by the medical profession. The Multnomah County Medical Society (Portland) has requested that a charge of three dollars be made to insurance companies for all reports pertaining to applicants or claimants. This action will eliminate attempts by insurance carriers to secure certified statements by radiologists without paying a fee.

* * *

The following resolution and motion were unanimously adopted at the San Antonio meeting of the *Texas Radiological Society* on Oct. 22, 1938:

WHEREAS, the science and art of radiology is a recognized specialty in the practice of medicine, and

WHEREAS, the hospitals supported by the State of Texas, the Veterans Bureau, and the Public Health Service are justly models for other hospitals, both private and charitable, and

WHEREAS, one of the requirements for Class A hospital rating recommends that the department of radiology be headed by a radiologist,

BE IT RESOLVED that the *Texas Radiological Society*, meeting in regular session, recommends that each of the hospitals supported by the State of Texas, the Veterans Bureau, and the United States Public Health Service have a properly qualified radiologist, preferably a diplomate of the American Board of Radiology, head their individual radiological departments.

The resolution was indorsed by the Texas State Board of Health at its annual meeting in December. The Texas State Medical Association will be asked to adopt it at the next annual session.

A schedule of fees for industrial work adopted by the *Iowa X-ray Club* a number of years ago has been enthusiastically supported by industrial insurance companies. It has eliminated the evil of occasional fees below the actual cost of complete and careful examination. Both radiologists and insurance companies are well pleased with the results of the project.

Iowa radiologists have likewise adopted a method for charging fees to the U. S. Employees Compensation Commission which assures a fair and adequate fee for examination of traumatic injuries suffered by workers employed by the Federal Government. The fee schedule issued by the ECC was proposed by the American Hospital Association and defrays the cost of technical work only. The inequities of the schedule have caused consternation and complaint by radiologists throughout the country. In Iowa, radiologists add a fair and reasonable fee for consultation to the ECC fee for technical work, bringing the total to equal the charge allowed by the industrial fee schedule mentioned above. These fees are paid by the ECC without objection.

* * *

Dismissal of the radiological staff of the Tampa Municipal Hospital and discharge of the hospital superintendent, followed by appointment of one man to serve in the dual capacity of superintendent-radiologist, touched off a controversy in *Florida* which culminated in a wholesale war involving the county medical society, the hospital trustees, and the mayor, and attracted the attention of the American Hospital Association, the American College of Surgeons, and the A.M.A. After months of debate, a new superintendent was appointed on Dec. 13, 1938. The salaried radiologist remains, however, supplanting the former staff which reimbursed the hospital on a percentage basis for its expenses in maintaining the department.

Following initial objections by the hospital staff and the county medical society, the hospital trustees received a letter from Bert W. Caldwell, Secretary of the A.H.A., congratulating the board upon its action and applauding the employment of a salaried radiologist as "good business as well as good administrative policy." Thereupon the American College of Surgeons removed the hospital from its approved list on the grounds that the dual responsibilities of superintendent and radiologist could not be successfully combined in

the hospital. Before the board of trustees had complied with the demands of the College of Surgeons, they received another request from the A.M.A. Council on Medical Education and Hospitals to take additional steps to comply with the principles of the Council. Beside replacing the superintendent, the board discharged from the staff fourteen doctors who were not members of the county medical society.

* * *

The following resolution, introduced by Dr. Stanley A. Clark, President of the *Indiana Roentgen Ray Society*, and Dr. A. S. Giordano, President of the Indiana Association of Pathologists, was adopted by the Indiana State Medical Association at its annual meeting on Oct. 4, 1938:

WHEREAS, The American Medical Association has through its House of Delegates and its various bureaus and councils from time to time propounded certain principles of ethics and established standards of relationships looking toward the maintenance of the highest quality of professional service both in private practice and in hospitals; and

WHEREAS, Many of these pronouncements refer specifically to those special branches of medicine involving somewhat unusual relationship between hospital institutions and the physician practising these specialties in the hospital; and

WHEREAS, Certain usages have sprung up which are tending to involve ethical and legal consideration; and

WHEREAS, It would appear to be highly desirable and in the best interests of good medical practice and sound public policy to have certain of the aforementioned pronouncements clarified, codified, and in some instances reiterated; and

WHEREAS, At the last meeting of the American Medical Association at San Francisco, in June, 1938, a resolution requesting the Council on Medical Education and Hospitals to study the status of clinical and pathologic laboratories, and radiologic departments in hospitals and institutions, with a view toward standardizing the relationship of these services to these institutions and, when necessary, reaffirming principles of ethics involved in these relationships; and

WHEREAS, The practice of medicine combines the exercise of professional knowledge and judgment and technical skill; and

WHEREAS, Hospitals and other lay organizations associated with physicians in the care of the sick find it essential to have available competent departments of roentgenology and clinical pathology; and

WHEREAS, Physicians especially trained in the selection, use, and interpretation of diagnostic aids in clinical pathology and roentgenology are a recognized necessity in medical practice; and

WHEREAS, The technical skill required in the practice of roentgenology and clinical pathology needs to

be supplemented by the professional knowledge and judgment of a physician before it is used in the diagnosis and treatment of disease; therefore:

BE IT RESOLVED, That the Indiana State Medical Association reaffirm the action of the House of Delegates of the American Medical Association, "that the practice of clinical pathology and roentgenology is the practice of medicine," and recommends that clinical and roentgenological laboratory services be excluded from service contracts which exclude other professional services; and

WHEREAS, Our duty to the sick and afflicted is to furnish the best service possible; therefore

BE IT FURTHER RESOLVED, That all laboratories practising these specialties should be recognized as being ethical only when they are operated and supervised by a physician trained and recognized as being competent in these specialties in medicine, and

BE IT FURTHER RESOLVED, That laboratories, which indulge in unfair competition by wholesale advertising of cut-rate prices, be specifically classed as unethical and unworthy of support by ethical members of the profession.

MAC F. CAHAL
Executive Secretary

540 N. Michigan Ave.
Chicago

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—Chairman, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; Secretary, Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—President, John F. Chapman, M.D., 65 N. Madison Ave., Pasadena; Vice-president, E. N. Liljedahl, M.D., 1241 Shatto St.; Secretary, Merl L. Pindell, M.D., 678 South Ferris Ave.; Treasurer, Henry Snure, M.D., 1414 Hope Street. Meets every second Wednesday of month at County Society Building.

Pacific Roentgen Club.—Chairman, Lyell C. Kinney, M.D., San Diego; Secretary, L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—Secretary, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—President, F. B. Stephenson, 452 Metropolitan Bldg.; Vice-president, K. D. A. Allen, M.D., 452 Metropolitan Bldg.; Secretary, E. A. Schmidt, M.D., 4200 E. Ninth Ave.; Treasurer, H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Chairman, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; Secretary-Treasurer, Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—President, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa;

Vice-president, H. B. McEuen, M.D., 126 W. Adams St., Jacksonville; Secretary-Treasurer, J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—President, James J. Clark, M.D., Doctors Bldg., Atlanta; Vice-president, William F. Lake, M.D., Medical Arts Bldg., Atlanta; Secretary-Treasurer, Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—President, David S. Beilin, M.D., 411 Garfield Ave.; Vice-president, Chester J. Challenger, M.D., 3117 Logan Blvd.; Secretary-Treasurer, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—President, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; Vice-president, Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; Secretary-Treasurer, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, Chairman, and Warren W. Furey, M.D., 6844 Oglesby Ave., Chicago, Secretary.

INDIANA

Indiana Roentgen Society.—President, Stanley Clark, M.D., 108 N. Main St., South Bend; President-elect, Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; Vice-president, A. C. Holley, M.D., Attica; Secretary-Treasurer, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Chairman, Whitmer B. Firor, M.D., 1100 N. Charles St.; Secretary, Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—President, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor;

Vice-president, Clarence Hufford, M.D., 421 Michigan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—*President*, E. R. Witwer, M.D., Harper Hospital, Detroit; *Vice-president*, D. W. Patterson, M.D., 622 Huron Street, Port Huron; *Secretary-Treasurer*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—*President*, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; *Vice-president*, Leo G. Rigler, M.D., University Hospitals, Minneapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—*President*, L. G. Allen, M.D., 907 N. 7th St. Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—*President*, Paul C. Schnoebelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—*President*, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—*President*, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Ray Society.—*President*, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island

College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—*President*, Walter Matlick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—*President*, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—*President*, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—*President*, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—*Chairman*, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Associated Radiologists of New York, Inc.—*President*, Albert L. Voltz, M.D., 115-120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. J. Francis, M.D., 121 Madison Ave., New York City; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—*President*, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—President, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; Vice-president, R. V. May, M.D., St. Luke's Hospital, Cleveland; Secretary-Treasurer, Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—President, B. M. Warne, M.D., Doctors Building, Cincinnati; Secretary-Treasurer, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—President, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; First Vice-president, Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; Second Vice-president, Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; Secretary-Treasurer, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; President-elect, Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; Editor, William E. Reiley, M.D., Clearfield. Annual meeting, May, 1939. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—President, Thomas P. Laughery, M.D., Germantown Hospital; Vice-president, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; Secretary, Barton H. Young, M.D., Temple University Hospital; Treasurer, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—President, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; Secretary, Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—President, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; Secretary-Treasurer, Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—President, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; Vice-president, Steve W. Coley, M.D., Methodist Hospital, Memphis; Secretary-Treasurer, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—President, Jerome H. Smith, M.D., San Antonio; President-elect, C. F. Crain, M.D., Corpus Christi; First Vice-president, M. H. Glover, M.D., Wichita Falls; Second Vice-president, G. D. Carlson, M.D., Dallas; Secretary-Treasurer, Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—President, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; Vice-president, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; Secretary, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—President, H. E. Nichols, M.D., Stimson Bldg., Seattle; Secretary, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary, H. W. Hefke, M.D., Milwaukee Hospital, Milwaukee. Meets monthly on first Friday.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

THE RESPONSIBILITY OF THE RADIOLOGIST IN THE TRAINING OF THE HOSPITAL INTERN IN FLUOROSCOPY¹

From the Department of Radiology of the College of Physicians and Surgeons, Columbia University, and of the Presbyterian Hospital, New York City

The topic assigned to me for discussion may appear on the surface to be simple. In reality it opens up a complex problem with far-reaching implications. It seems advisable to begin by making sure of the meaning of three words used in the title, namely, *intern*, *fluoroscopy*, and *training*.

DEFINITION OF TERMS

The interns referred to are those taking general medical, surgical, or rotating services.

The fluoroscope is ordinarily used for the examination of the heart, lungs, and gastro-intestinal tract. Employed as an orthodiagraph, it suffices for the heart. The proper examination of the gastro-intestinal tract and lungs requires also the use of films. Although an experienced observer can detect relatively small lesions by fluoroscopy, the neophyte may demonstrate only certain grosser changes, some of which, however, because of physical conditions or location might be impossible to detect by physical examination. A permanent record for detailed study and for comparison later is lacking. Fluoroscopy is safe only when its limitations are clearly recognized. I have the impression that the term as used in the title refers primarily to the examination of the chest and heart. The fluoroscope is used in the reduction of fractures by interns and other members of the surgical staff in many hospitals. It is a hazardous procedure and those using it must be made fully aware of the danger to their fingers and to the patient's skin. Except in this connection, fluoroscopy in fracture reduction is not part of the problem.

The term "training," to my mind, means more than a mere opportunity to observe. It

connotes the development of experience in a series of steps with increasing personal responsibility under supervision; in other words, apprenticeship. Only in this way can real knowledge be acquired.

OBJECTIVE OF TRAINING

The objective of training interns in fluoroscopy must be outlined. An eminent professor of medicine remarked more than fifteen years ago that if he were "coming through" now he would spend a year in radiology for the sake of the training in medicine that it affords. There is no question about the amount of medical knowledge to be acquired in a department of radiology. The objective implied in the title of this discussion, however, seems a little more specific. Many internists and general practitioners fluoroscope the chest of their patients as a routine and some even attempt to examine the stomach. Recognizing its limitations, many of them feel that a routine fluoroscopic survey of the chest is a valuable addition to the physical examination. Therefore, one objective of this training of interns would presumably be to enable them to use the method later in practice more intelligently and with consciousness of its dangers. The proponents of this idea maintain that it would tend to make the intern more familiar with the possibilities of radiologic methods, more sympathetic toward the efforts of well-trained radiologists, and more acutely aware of his own limitations. Could it be attained, this objective would meet with universal approval. Also to be mentioned is the problem of the man who is to practise in a small community where the help of a trained radiologist is not available.

In two States, the Board of Licensure requires a period of training of not less than six weeks in radiologic technic and interpretation.

¹ Presented at the Eighth Annual Conference of the American College of Radiology, Chicago, Feb. 13, 1938.

An official of one of these boards is quoted as having stated that the purpose of the regulation is to prevent practitioners from injuring patients with the x-ray. This is apparently based upon the assumption that the vast majority of medical men will try to operate x-ray machines.

It seems obvious that this question is linked with the future development of radiology. Will the greater part of radiologic diagnosis be done in the offices of internists, surgeons, and general practitioners, and the radiologist be used for special procedures, for difficult cases, and, in general, as a consultant on films made by others? Considerable work of poor quality is being done at the present time in the offices of clinicians. What might be the effect on this trend of the training of interns in fluoroscopy?

OPINIONS OF RADIOLOGISTS

To get some information as to what is being done now, I wrote to over 130 radiologists in all parts of the country, some connected with large teaching institutions and others with smaller community hospitals, and asked them whether or not they were making an attempt formally to train interns in fluoroscopy. The possible significance of this move was mentioned and they were requested to comment on the proposal. One hundred fourteen replies were received in time to be examined. Seven either are not connected with hospitals or made no statement regarding the policy of their institution. In seven hospitals instruction in fluoroscopy is given and in 100 it is not. Three of the seven are affiliated with medical schools for the teaching of undergraduates, three are in smaller cities where there is no medical school, and one was a small specialty hospital. To these should be added another teaching hospital, information concerning which came from the professor of surgery.

In nine other institutions interns have a definite period of their service in the x-ray department but do not do any fluoroscopy themselves. Some of these are specialty hospitals. The length of service varies from one to four months. One radiologist remarked that he was discontinuing the service because some of the ex-interns had purchased machines and stated that they had been trained in radiology at this institution.

I am told that the late Dr. Hickey also tried the experiment of having the hospital interns rotate through the department of radiology—for a period of two months, I think—but discon-

tinued it after two years. I was not able to get any more specific information than that.

In a few places the opportunity is offered interns of staying on in the x-ray department for from one to six months after the regular service is completed. Most of the radiologists in these institutions stated that they were emphasizing the possibilities, limitations, and hazards of diagnostic work with the idea of increasing the intern's respect for it, rather than trying to teach him to do it.

I also asked these radiologists whether they thought interns should be given training in fluoroscopy. Of the 114, nine made no comment, 89 opposed it, and 16 were in favor of it. Nine of the 16 who favored it are connected with hospitals where it is not done, three are doing it, and three now have no hospital responsibilities. Of the seven institutions where interns are given training in fluoroscopy, it seems that the radiologists of three approve the idea, two oppose it, and two did not express an opinion.

It is of interest to note that among the 16 radiologists who favor the training of interns in fluoroscopy, are some prominent teachers of radiology. One well-known teacher believes that internships are too full now to permit this training and that all medical students should be taught to use the fluoroscope just as they are taught the use of the ophthalmoscope. Another professor of radiology offers an elective course in fluoroscopy to fourth-year medical students which practically all of them take. In groups of two, they spend one and a half hours on six consecutive days in the fluoroscopic room and each is required to do one complete gastro-intestinal examination. This radiologist does not look upon this method as instruction in the technic of fluoroscopy but as an attempt to fix the student's attention upon the examination so that he will better understand and sympathize with what the radiologist is trying to do.

Some radiologists expressed sympathy for the intern who expects to settle in a small community where expert help is not available and were taking steps to help him. One well-known teacher of radiology remarked that nothing but good could come from teaching interns fluoroscopy but he does not permit anyone not connected with his department to use a fluoroscope. Another believes that the broader the intern's knowledge the less likely is he to overstep his limitations.

Although opposed to the proposition as

stated, the vast majority of replies emphasize the importance of giving the intern as much information as possible regarding the field of diagnostic radiology, its usefulness, limitations, and dangers. To this end they welcome the interns to formal conferences, to informal consultations, and to the fluoroscopic rooms as observers of the examination of patients in whom they are interested. Many felt that the internship was already too full to include a service in radiology and that not enough time would be available to give the intern anything worth while, that a brief period of training would give the man a false idea of his competence with resulting serious danger to himself and to his patients, and that an increase in the amount of incompetent office radiology would result. A few have the impression that the interns are not interested in taking an x-ray service. Many agreed that an anatomical specialist, such as a chest man or a gastro-enterologist, could acquire enough experience to become well versed in the radiology of his specialty, but pointed out the danger of a temptation to step beyond that field. Some radiologists expressed the opinion that if a clinician wishes to use a fluoroscope or other radiological methods he should have more training than is possible during an internship.

It appears from these letters that the number of medical practitioners who own fluoroscopes or more complete x-ray equipment varies considerably in different communities. Some radiologists believe that this will increase, that it would be inadvisable to attempt to stop it, and that every effort should be made to guide this trend, in order to avert the consequences of ignorance. A few feel that an up-to-date clinician, while realizing the limitations of the method, must fluoroscope his patient's chest. A radiologist of large experience stated that a fluoroscope installed in the office of a practitioner usually results in more work referred to the radiologist. A younger man made a similar observation but added that the radiologist must maintain superiority of knowledge. On the other hand, office radiology by the practitioner, in the experience of two other men, usually results in requests for free consultation with specialists.

OPINIONS OF PROFESSORS OF MEDICINE AND SURGERY

To get other points of view, I wrote to 16 professors of medicine and the same number

of professors of surgery in medical schools throughout the country, and asked for an opinion as to the advisability of training interns in fluoroscopy. I attempted to set before them the reasons why this problem is brought up for discussion and its significance from the radiologist's standpoint.

Of the 13 professors of medicine who replied, nine are opposed to it, three favor it, and one did not make his opinion clear, although he believes the fluoroscope to be an indispensable part of an internist's equipment. One, who favored it, would limit the training to the heart and lungs; he believes two months' service should suffice but finds it impossible to arrange under present conditions. Another, who favors it, would include all radiology and believes the dangers of incomplete preparation no greater than in any medical training. The fears expressed by those opposed were much the same as those of the radiologists—insufficient training, danger of not recognizing limitations, etc. One, who opposed it, thinks that most interns will not want to use the fluoroscope in their practice, that it would not be fair to make all of them take a service in the x-ray department, and that special arrangements should be made for the interested few. Two mentioned the use of fluoroscopes by members of the medical service independently of the department of radiology.

Of the ten professors of surgery who replied, seven are opposed to the training of interns in fluoroscopy, and three favor it. Those opposed expressed fear of the results of incomplete training, much as did the internists. One, who opposed it, thinks it should be possible for a man who intends to practise in a small community to take an x-ray service of a few months following his regular internship, but a man in a community where specialists are available should not attempt to do x-ray work. It is of considerable interest that, of the 23 clinicians who replied, only two, both surgeons, mentioned the danger of injury from the rays, in contrast to the frequency with which it was mentioned by the radiologists.

CONCLUSIONS

It is quite apparent that a difference of opinion exists among both clinicians and radiologists in regard to the training of interns in fluoroscopy. In two medical schools the professors of medicine and surgery are in disagreement on this question; in another, the

professors of radiology and surgery favor it while the professor of medicine is opposed to it. This difference of opinion exists even among very young medical men, as I found when I questioned a dozen or more.

In attempting to formulate a policy in the presence of such divergence of opinion, it is well to remember that the roentgen method of physical examination occupies a pre-eminent place among diagnostic procedures. Its continual improvement is dependent upon the work of men who devote all their time to it. In general they will do it better than anyone else in their medical community. Anything which would interfere with their interest and activity would hamper the development of radiology, would not be for the good of medicine, and eventually would affect adversely the welfare of patients. But the weakness as well as the strength of radiology is in its great importance in medicine. It must be applied as widely as possible and yet used accurately and safely. To attempt to control its use by edict would be highly inadvisable even if possible. This must be done by education. The radiologist must be alert to learn from his clinical colleagues, must show the young medical man by precept and example the importance of careful, accurate diagnostic work, and discourage inefficient radiology by the medical practitioner.

The problem resolves itself into a question as to whether training an intern in fluoroscopy, or perhaps more extensively in radiology, would give him a false feeling of sufficiency and encourage him to attempt things he should not try to do, or whether it would make him realize both the limitations of the method and of himself, as well as the need for prolonged special training in this field. I would be presumptuous, indeed, to pretend to know the answer to this question. However, I am inclined to agree with those who uphold the proposition that the more a good clinician knows about radiology, the more respect he will have for it and the more he will appreciate good work in it. From the practical standpoint it seems questionable whether real training in fluoroscopy can be satisfactorily integrated with a hospital internship. It certainly should not be attempted in a one-year rotating service. Possibly those who are taking the occasional young man into the x-ray department for from three to six months at the close of the internship have a better solution alike for him who desires orientation from

a general medical standpoint, for him who feels he must fluoroscope his patients' chests, and for him who must do some radiology in a small community practice. If it must be done during a hospital service, it would seem to me quite undesirable to take the intern for an hour or two a day or to permit him to have responsibilities elsewhere at the same time that his service in the x-ray department is going on. If this training is to be attempted at all, the intern should become temporarily a member of the department of radiology and should receive as broad an experience as possible. It could not be limited to fluoroscopy alone, as the study of films is necessary to check upon the accuracy of screen observations. The effect on his future conduct will probably be dependent in part upon his personal character and intellectual honesty, and in part upon the skill of his radiological preceptor. The experiments along this line now being carried on in some institutions will be watched with interest; their effect upon young men should be the subject of further study.

In conclusion, I wish to thank the gentlemen who so kindly replied to my letters and to pay tribute to the obvious honesty and sincerity of their opinions.

ROSS GOLDEN, M.D.

ANNOUNCEMENT

AMERICAN CONGRESS ON OBSTETRICS AND GYNECOLOGY

This Congress, sponsored by the American Committee on Maternal Welfare, Inc., will meet in Cleveland, Ohio, Sept. 11-15, 1939. The member organizations of the American Committee on Maternal Welfare, Inc., are the following: American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, American College of Surgeons, American Gynecological Society, American Hospital Association, American Nurses Association, American Protestant Hospital Association, American Medical Association (Section on Obstetrics and Gynecology), American Public Health Association, Catholic Hospital Association, Central Association of Obstetricians and Gynecologists, Chicago Maternity Center, League of Nursing Education, Maternity Center Association of New York, National Medical Association, National Organization for Public Health Nurs-

ing, New England Obstetrical and Gynecological Society, Pacific Coast Society of Obstetrics and Gynecology, Southern Medical Association, U. S. Bureau of the Census, U. S. Children's Bureau, and U. S. Public Health Service.

The purpose of the Congress is to present a program of our present-day medical, nursing, and health problems from a scientific, practical, educational, and economic viewpoint so far as they relate to human reproduction and maternal and neonatal care. This is not in any sense a legislative body and will take no action relative to maternal and infant care. Its purpose is, as clearly stated, to be a Congress for the presentation of scientific material, mostly of factual type.

The five-day sessions are being planned as follows: Mornings, special programs for each organization group and sub-groups; afternoons, joint sessions of general interest to all members attending; evenings, meetings for all members, with speakers of national prominence. There will be scientific and educational, as well as technical and commercial exhibits.

Fred L. Adair, M.D., Chicago, is *General Chairman*; Robert D. Mussey, M.D., Rochester, Minn., *Vice-chairman*; Sara B. Place, Chicago, *Secretary*; Rudolph W. Holmes, M.D., Chicago, *Treasurer*, and Frederick H. Falls, M.D., Chicago, *Assistant Treasurer*.

Further information may be obtained at the Central Office, 650 Rush Street, Chicago, Illinois.

COMMUNICATION

PRESENTATION OF A MEDAL TO DR. BELOT IN PARIS

On Dec. 13, 1938, at the Marcellin-Berthelot Center in Paris, Dr. J. Belot was presented with a medal by his many friends and students in honor of his contributions to radiology as an investigator and a teacher. Dr. Belot is the Director of the Department of Radiology at the Saint-Louis and the Villejuif Hospitals in Paris. Leader of the French delegation, many Americans had the pleasure of meeting him at the Fifth International Congress of Radiology, in Chicago, in September, 1937. The presentation took place before a large assembly which included radiologists from several foreign countries as well as his colleagues in France, professors of the faculty of medicine, and doctors from the various Parisian hospitals. A num-

ber of laudatory speeches were made, outlining Dr. Belot's life and his career as a radiologist.

His American friends wish to add their congratulations to those of his European colleagues upon this well deserved honor.

IN MEMORIAM

We have taken time for the careful preparation of a biographical sketch of Dr. Childs, together with a bibliography of his contributions to medical literature, designedly. We seldom publish an obituary notice, believing such sad reminders are best left to the regular channels; when we do vary from this rule it is with the purpose of letting our readers derive information as well as inspiration from the lives of their departed friends.

SAMUEL BERESFORD CHILDS, M.D.

1861-1938

Samuel Beresford Childs was born Nov. 5, 1861, in East Hartford, Connecticut, the son of Seth Lee and Juliet Wood Childs. The simple relation of the chronological events and incidents of his life is a poor substitute for having known the man. Those who were fortunate enough to have met and talked with him, however briefly, must cherish the impression of a life full, rich, kindly, and valuable; one whose contact was worth having and which enriched the world by simply having been.

Dr. Childs' primary and secondary school education was obtained in Hartford. In 1883, he graduated from Yale University with the degree of Bachelor of Arts, and in 1887, he obtained the degree of Doctor of Medicine from the New York University Medical College. His internships were at the Out-patient Department of the Chambers Street Hospital, New York (1887), and as resident in the Hartford (Connecticut) Hospital (1887-1888). Doctor Childs practised medicine in Hartford from 1888 to 1895, during which time he married Henrietta Willette, of West Hebron, New York (1890). In 1895, he went to Texas because of pulmonary tuberculosis. On Dec. 15, 1896, his son, John Wood Childs, was born. In 1898 Dr. Childs began the practice of medicine in Denver, and in November, 1899, he was elected to membership in the Denver and Arapahoe Medical Society. Shortly after that he was

given the Chair of Anatomy at the University of Denver Medical College, which later became the Denver and Gross Medical College, which in turn was absorbed by the University of Colorado Medical School.

In 1906, his wife died, and in 1908 he married Anne Starling, of Henderson, Kentucky. A second son, Samuel Beresford Childs, Junior, was born Jan. 14, 1910. The second wife died April 12, 1935, and about eighteen months later Dr. Childs married Mrs. Nan Bullione Palmer, who, with his sons and three grandchildren, survive him.

About 1928, he developed high blood pressure. Although this condition responded to medical therapy, he had occasional disturbances which probably influenced him to retire from active practice in August, 1937. He died May 21, 1938, of bronchial pneumonia.

Dr. Childs was one of those who became interested in the x-ray soon after it was announced, and as early as 1900 he began employing it in his practice. By 1902 he had obtained a Waite and Bartlett static machine, had studied skin therapy under Dr. Pusey in Chicago, and had spent some time with Mr. John McIntosh who was the demonstrator for the Waite and Bartlett Company. After his return from Chicago he specialized in radiology, and from that time on he devoted his energies to improvement of technic and development of skill in diagnosing and treating disease by the roentgen ray.

His interest in radiology made him a pioneer in that field and prompted him to make constant contributions to medical publications. A partial bibliography of his work is appended. On Aug. 14, 1902, he had an unique experience. He made a roentgenogram of the right kidney of a patient, with an exposure of fifteen minutes. When he related this incident to the interviewer several years ago, his face took on a glow of combined humor and whimsicality. He said, "I put the plate in the developer, and waited. After what I thought a reasonable time, I looked at it, but I could see nothing. So I rocked the pan, for—oh, what seemed to me about an hour; anyhow, until I was disgusted and put the plate in water and left the dark room. I ordered new developer, made it up, and put the plate in it. This was different: in about two or three minutes I began to see a shadow. When it was dark enough I finished the dark room manipulation. Later when I studied the dry plate, I saw not only the outline of the kidney, as I expected, but another shadow which I interpreted to be a stone in the

pelvis. I reported accordingly to the physician, Dr. W. A. Jayne, and he confirmed the diagnosis at operation later."

Dr. Childs was an early advocate of the lateral as well as anteroposterior roentgenogram to determine the position of fractures.

Dr. Robert Levy recalled an instance illustrative of Dr. Childs' ever-present willingness to improve his own technic as well as help others to do the same. In 1905, a patient was referred to Dr. Levy for removal of a foreign body from a bronchus. The roentgenogram revealed the object, but there was doubt as to the exact location and especially as to the particular bronchus in which it lay. To orientate himself for bronchoscopy, Dr. Levy obtained a cadaver and injected the bronchial tree *in situ* with an opaque medium. Dr. Childs made a roentgenogram of the injected cadaver thorax, which Dr. Levy studied carefully, comparing it with the one of the living patient. The bronchoscopic removal was successful.

Dr. Childs was a member of the Yale baseball team while a student there, and later played professional baseball as a member of the Hartford team in the National League. He and Connie Mack were very close friends. In later years he took up golf; also, he loved to hunt and fish.

Prior to his retirement from active practice in August, 1937, Dr. Childs had won many honors for his years of medical service. He served the Denver County Medical Society as treasurer for a term, as vice-president in 1916, as president in 1917, and as trustee from 1918 until August, 1937. For a number of those years he was chairman of the board of trustees. He was vice-president of the Colorado-Yale Association in 1909, and president in 1911. He was president of the staff of St. Luke's Hospital (Denver) 1923-1925, of the American College of Radiology 1925-1926, of the Colorado State Medical Society 1928-1929, and of the American Medical Golfing Association. He was the first President of the Denver Radiological Club. At the time of his death he was a member of the staff of the following hospitals, all of Denver: St. Luke's, St. Joseph's, Mercy, Denver General, Colorado General, and National Jewish. He was a member of the Denver County Medical Society, the Colorado State Medical Society, the American Medical Association, the Denver Clinical and Pathological Society, the American Roentgen Ray Society, the Radiological Society of North America, the American College

of Radiology, the Denver Radiological Club, the Colorado-Yale Association, and Professor emeritus of Roentgenology of the University of Colorado Medical School.

JOHN S. BOUSLOG, M.D.

PARTIAL BIBLIOGRAPHY

Cases Illustrating the Therapeutic Uses of the Roentgen Ray. *Medical News*, 82, 145, 1903.

— and SEWALL, HENRY: The Interpretation of X-ray Pictures as an Aid to the Early Diagnosis of Thoracic Aneurysm. *Am. Jour. Med. Sci.*, 134, 360, 1907.

The Importance of the Roentgen Ray in the Diagnosis of Bone Disease. *Medical Record*, 81, 112, 1912.

— and SEWALL, HENRY: A Comparison of Physical Signs and X-ray Pictures of the Chest in the Early Stages of Tuberculosis. *Arch. Int. Med.*, 10, 45, 1912.

— and SPITZER, WILLIAM E.: Roentgenographic Study of the Normal Kidney, its Pelvis and Ureter. *Jour. Am. Med. Assn.*, 61, 925, 1913.

A Plea for Conservatism in the Treatment of Closed Fractures from a Roentgenological Standpoint: Demonstration of End-results. *Am. Jour. Roentgenol.*, 3, 390, August, 1916.

LANZA, A. J., and —: Miner's Consumption. *Public Health Bulletin No. 85*, January 1, 1917.

Importance of Correlation by Roentgenologist of Clinical and Roentgen-ray Findings in Pathological Conditions. *Jour. Radiology*, 2, 18, March, 1921.

Newgrowths within the Chest: X-ray Diagnosis. *Am. Jour. Roentgenol. and Rad. Ther.*, 10, 175-182, March, 1923.

Appendicitis and Lesions Complicating its Diagnosis: Deductions from X-ray Examinations. *RADIOLOGY*, 4, 107-110, February, 1925.

Medicine To-day and To-morrow. *Colo. Med.*, 25, 316-320, October, 1928.

the Study of Tuberculosis; E. L. Middleton, M.D., D.P.H., H. M. Medical Inspector of Factories, London, England. A volume of 439 pages. Published by Oxford University Press, New York, 1938. Price: \$4.25.

ORTHOPEDIC APPLIANCES—THE PRINCIPLES AND PRACTICE OF BRACE CONSTRUCTION FOR THE USE OF ORTHOPEDIC SURGEONS AND BRACE MAKERS. By HENRY H. JORDAN, M.D. Foreword by E. G. Brackett, M.D., Editor of the *Journal of Bone and Joint Surgery*. A volume of 411 pages, with 176 illustrations. Published by Oxford University Press, New York, 1938. Price: \$4.00.

BOOK REVIEWS

DIAGNOSTICO DOS ANEURYSMAS DA AORTA THORACICA (Diagnosis of Aneurysms of the Thoracic Aorta). By GERALDO DE ANDRADE, Physician to Pedro II Hospital, Chief of Clinic of the Portuguese Hospital, and member of the Staff of the Medical Faculty of Recife, and AGUINALDO LINS, Chief of the Radiological Service of the Faculty of Medicine of Recife. A volume of 328 pages, with one plate, 40 halftones, and 52 roentgenograms. Published by Companhia Editora Nacional, São Paulo, Brazil. Price not stated.

The reader is offered an orderly presentation of the entire subject of thoracic aneurysms, commencing with definitions, statistical data, constitutional and congenital factors, proceeding to the physical examination in most minute detail, and a long analysis of the symptomatology. It seems hardly possible for the authors to have omitted a single one of the numerous signs and symptoms described anywhere in the literature. Although only about twenty-five pages are devoted to the purely radiological aspects of the subject, the radiological findings are worked into the text in every appropriate place. The numerous radiographic illustrations add much to the value of the text. The authors deserve commendation for the thoroughness of presentation of a disease of which they enjoy a very rich material.

BOOKS RECEIVED

Books received are acknowledged under this heading, and such notice may be regarded as an acknowledgment of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

SILICOSIS AND ASBESTOSIS. Edited by A. J. LANZA, M.D., Assistant Medical Director, Metropolitan Life Insurance Company; Chairman, Industrial Hygiene Committee of the New York Tuberculosis and Health Association. Contributors: R. R. Sayers, A.M., M.D., Senior Surgeon, U. S. Public Health Service; Chief, Division of Industrial Hygiene, National Institute of Health, formerly Chief Surgeon, United States Bureau of Mines; Eugene P. Pendergrass, M.D., Professor of Radiology, Medical School, University of Pennsylvania; Professor of Radiology, Graduate School of Medicine, University of Pennsylvania; Associate Director, Department of Radiology, Hospital of the University of Pennsylvania; S. Roodhouse Gloyne, M.D., D.P.H., Pathologist, Pathological Laboratories and Research Institute, The London Chest Hospital; Leroy U. Gardner, M.D., Director, Saranac Laboratory for

RÖNTGENDIAGNOSTIK DER KNOCHEN- UND GELENKKRANKHEITEN (Roentgen Diagnosis of Diseases of the Bones and Joints). By Prof. Dr. ROBERT KIENBÖCK, Vienna. Vol. 5 (Section on Joint Diseases, pages 451-1049), Rheumatoid Joint Tuberculosis. With

610 illustrations in the text. Published by Urban & Schwarzenberg, Berlin, 1938. Price: R.M. 60.

This volume of 598 pages is essentially an atlas of cases of various types of bone and joint lesions which are considered by the author as tuberculous. The first half of the volume is devoted to what he calls "*Rheumatoide Gelenkstuberkulose*." This is the condition long known in this country as Poncet's *rheumatisme Tuberculeux*. Many of us have not been willing to recognize this condition as an entity; however, for those looking for support for this thesis this work should be a great help.

The second half of the volume is devoted to Destructive Joint Tuberculosis. Again numerous case reports are given, in more or less detail, together with their roentgenograms, and much material is thereby presented.

The volume is another of those contributions by the same author presenting essentially a series of atlases of diseases of the bones and joints and as such is an important addition to the series. It covers this subject with a wide variety of case reports and furnishes material for an extensive study of this condition. This section completes the volumes on joint conditions.

PRIMARY CARCINOMA OF THE LUNG. By EDWIN J. SIMONS, M.D., Member of the Staff of St. Gabriel's Hospital, Little Falls, Minn., and Lymanhurst Health Center, Minneapolis, and Visiting Consultant in Medicine, Minnesota State Sanatorium, Ah-Gwah-Ching, Minn. Foreword by J. Arthur Myers, M.D., Professor of Medicine and Preventive Medicine and Public Health, University of Minnesota. A volume of 263 pages, 30 illustrations, numerous tables, and two color plates. Published by the Year Book Publishers, Chicago, Ill., 1937. Price: \$5.00.

This is the most comprehensive review of the literature concerning primary carcinoma of the lung that has appeared since Adler's work in 1912. It is remarkable in that it has been written, and very ably so, by a rural practitioner whose interest in the subject was aroused by the occurrence in his practice of two cases within two years.

Facts and figures have been presented which prove definitely a real and not merely an apparent increase of pulmonary carcinoma. Concerning etiology, it has been found that

various ones or combinations of the fourteen etiologic agents most frequently referred to in the literature may be the cause of isolated cases, or may have been to some extent responsible for its general increased frequency. Histologically the cases may be composed of any of the following three fundamental types of cells and all cases may be grouped under one or another of three headings: (1) squamous cells, (2) adenocarcinomas, and (3) undifferentiated round- or spindle-cell growths. It is now generally conceded that all bronchiogenic or pulmonary carcinomas originate from one parent cell—the undifferentiated basal cell of the bronchial epithelium. The discussion of the clinical features begins with an analysis of 5,921 cases as to sex incidence. The analysis of the various symptoms is based on 1,456 cases.

The various physical signs are classified and discussed with a view to emphasizing their importance. Different classifications of the x-ray features of the disease are considered and the grouping of the tumors roentgenologically as either hilar or peripheral is advocated. Under diagnosis are recapitulated all the symptoms, physical findings, and results of special procedures considered most indicative of pulmonary cancers. A dissertation of the treatment considering symptomatic measures, irradiation, and surgery concludes the study.

While this has been said to be a book by a general practitioner for general practitioners, it is decidedly more than that and many in the specialist class should be grateful for this volume.

A HANDBOOK OF ROENTGEN AND RADIUM THERAPY. By A. J. DELARIO, B.A., M.D., Radiologist, St. Joseph's Hospital, Paterson, N. J., and Community Hospital, Montclair, N. J. A volume of 362 pages, illustrated with numerous engravings, graphs and tables, and one colored plate. Published by F. A. Davis Company, Philadelphia, 1938. Price: \$8.00.

The author has assembled in book form information which has proved valuable to him and has added charts, graphs, and tables of his own. The absorption of roentgen rays is discussed in five and a half pages, the physical and chemical changes produced in tissues by roentgen rays in one and a half pages, the recovery of tissues in seven pages, radium therapy in twenty-one pages, the bibliography in fifteen pages. The figures and charts arranged to explain the physics of roentgen and radium waves and their practical applications occupies ninety-

five pages. The third part, on end-results, takes 138 pages.

This notebook contains many facts. Its contents, however, seem to be sketchy, superficial, incomplete, and largely non-critical. The material presented is easily available to the radiologist or student of radiology in better and more comprehensive texts.

SHORT WAVE THERAPY. Second English Edition. By E. SCHLIEPHAKE, Dozent of the University of Giessen. Authorized English translation by R. KING BROWN, B.A., M.D., D.P.H. A volume of 296 pages, with 148 illustrations. Published by The Actinic Press, Ltd., London, 1938. Price: 21/- net.

The second edition of this work is divided into eight sections, as follows: nature and development, medical uses, the short wave method, experimental section, pathologic processes, treatment of human diseases, general conclusions, and appendix. The text perpetuates many of the erroneous conclusions found in the first edition. The author still believes in selective heating effects and in specific biologic and bactericidal effects of short radio waves. This is contrary to the generally accepted views in this country and is not in agreement with the conclusions of the Council on Physical Therapy of the American Medical Association. In the clinical section are many enthusiastic claims concerning the value of short wave diathermy. Schliephake's book is recommended only to those enthusiasts who desire a complete set of books on the subject of short wave diathermy. To such readers it is suggested that Schliephake's conclusions be taken with a grain of salt.

PYRÉTHÉRAPIE (Fever Therapy). By CHARLES RICHET, JEAN SURMONT, and PIERRE LE GÔ. A volume of 195 pages, with illustrations. Published by Masson et Cie, Paris, 1938. Price: 50 francs.

The senior author (Richet) of this new and interesting French text on fever therapy created a very favorable impression upon his American listeners when he spoke at the International Congress on Fever Therapy held in New York in 1937. As was to be expected, therefore, the text-book is an excellent exposition of the subject. As seems often to be the case with French publications, the authors are long on theory

and a little short on certain facts. There is not enough presentation of controlled clinical studies on the clinical action of fever therapy.

The text is divided into three sections, the first dealing with biologic data, the second with technic, and the third with clinical results. In their conclusions the authors state that they have attempted to combine the facts and theories presented in a number of congresses, articles, and communications concerning fever therapy. In this attempt they have succeeded. The presentation is a complete and logical summary of the subject of fever therapy and is to be recommended to all physicians who are interested in this subject.

THE MEDICAL APPLICATION OF SHORT WAVE CURRENT. By WILLIAM BIERMAN. Including a discussion of its physical and technical aspects by MYRON M. SCHWARZSCHILD. A volume of 379 pages, with 85 illustrations. Published by William Wood and Company, Baltimore, 1938. Price: \$5.00.

This new text-book on short wave diathermy is undoubtedly the best book on this subject in English. Like a number of other books in this field, an extremely large portion of the text is devoted to rather complicated physical aspects of the problem. Although it is true that the physical fundamentals of the subject are highly important, and although it is true that the physical aspects of short wave diathermy are more simply and lucidly presented in this text than in any previous text on the subject, the average practitioner of medicine will not care to make the effort to comprehend equations like the following, which appear in Table V:

$$R_s = \frac{K}{2} \frac{p}{2} \quad Q_s = \frac{K}{2} \frac{p}{2}$$

$$Kp + Sp \quad Kp + Kp$$

Such equations leave the reviewer gasping and bewildered, and he is inclined to believe that there are other physicians like him. Nevertheless, Schwarzschild has unquestionably done an excellent job in presenting a difficult subject in a highly scientific manner.

The other two-thirds of the book are concerned with history, temperature determinations, physical responses, specificity, technic, introduction to clinical applications, and clinical applications. The book is well illustrated,

the context is presented in very readable style, and in a highly authoritative manner. There is an extensive bibliography appended. The volume can be recommended most highly and should be in the hands of every physician who is interested in the subject of short wave diathermy.

TRAITE D'ELECTRORADIOTHERAPIE (Treatise on Electroradiography). By L. DELHERM and A. LA QUERRIERE, with 88 collaborators. Two volumes which contain 2018 pages, with 450 figures. Published by Masson et Cie, Paris, 1938. Price: 480 francs.

This voluminous French work, edited by Delherm and La Querriere with eighty-eight co'laborators, is a most interesting presentation. Following the preface by Prof. d'Arsonval, appears an historical sketch by La Querriere, Delherm, and Stronzer. The text is so extensive that a mere recitation of the headings of the chapters which appear in its two large volumes would consume more space than is used in the average review. Suffice it to say that the first volume deals with fundamentals, action of electric currents and radiations, electric accidents and dangers, and the fundamentals of the biologic action of roentgen rays and radio-active bodies. A second portion of the first volume is devoted to the clinical aspects of the subject, discussing diseases of the nervous system, electro-diagnosis, chronaxy, electroradiotherapy in various diseases with special reference to the nervous system, muscular diseases, atrophic disorders, endocrine glands, and diseases of nutrition. The second volume is divided into seventeen additional sections, starting with a section on diseases of infancy in which rickets, spasmodophilia, tetany, acrodynia, spasmoparalytic affections, and infantile myotonias and hyper-tonias are discussed. Following this are sec-

tions on diseases of the skin, respiratory tract, cardiovascular apparatus, blood, lymphatics, digestive tract, genito-urinary tract (male and female), tropical diseases, foreign bodies, surgical lesions, diseases of the ear, nose and throat, ocular diseases, and diseases of the mouth. The final section deals with legislation and medical jurisprudence in relation to electroradiotherapy. This authoritative and extensive work can be recommended to anyone interested in this particular field of medicine.

PRAXIS UND ERGEBNISSE DES KURZWELLEN-HEILVERFAHRENS BEI ALLGEMEINTHERAPEUTISCH RESISTENTEN ERKRANKUNGSFORMEN (Practice and Results with Short Wave Treatment Methods in Diseases Resistant to General Therapeutic Methods). By L. H. STIEBÖCK. A monograph containing 67 pages, with illustrations. Published by Urban & Schwarzenberg, Berlin, 1937. Price not stated.

(NOTE: This small monograph, taken from *Ergebnisse der gesamten Medizin*, by Prof. Dr. Th. Brugsch.)

This short monograph presents rather enthusiastically the author's personal views concerning the value of short wave therapy (usually spoken of in this country as "short wave diathermy") in the treatment of numerous diseases. The very extensive list of diseases alone leads one to be somewhat dubious concerning the results mentioned. For example, one might question the author's claim that in 44 cases of otosclerosis, 25 of the patients were improved, and that in 43 cases grouped together under the heading "myositis ossificans non-progressive, myalgia and lumbago," 39 of the patients were cured, four were improved. To those who are interested in short wave diathermy, this monograph may be of interest; however, the reviewer is somewhat skeptical concerning the statistical data presented.

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APPARATUS

The Dependence of the Ionization Current on Volume of Small Ionization Chambers. U. Henschke. *Strahlentherapie*, 62, 614, 1938.

The author investigated the relation between volume of a small ionization chamber and the ionization current. He describes his experimental setup and discusses the possible sources of error. He then relates the measurements taken with a sphere chamber, with the pressure within the chamber varying from 3 to 750 mm. Hg., with a cylindric chamber, and with plate condensers. The potential range was from 40 to 170 kv., beginning with no filter up to 1 mm. Cu. He found that there was very little deviation from the proportionality between volume and ionization current for the chambers used. He feels that except for the experiment with varying pressure this was surely within the limit of error. The influence of the wave length detected in his measurements is explained by the fact that the chamber material used had a slightly larger electron emission than air.

ERNST A. POHLE, M.D., Ph.D.

Five Years' Experience of Modern Shock-proof and Ray-proof Containers for Roentgen Therapy Tubes. R. Thoracius. *Acta Radiol.*, 19, 174-184, May, 1938.

The uniformity of operating conditions and of equipment prevailing in Sweden, combined with regular semi-annual check-ups of the physical and technical factors by direct measurements, allows more definite conclusions than are possible in other countries. Special attention is devoted to the economic factors, and a formula has been developed to express the cost of modern shock- and ray-proof container equipment distributed over a number of years.

The formula is $A = N(C - \frac{P}{T})$ in which A signifies

the cost amortization; P, price of the tube; T, tube life in hours; N, hours of operation per year, and C, tube cost per hour of operation.

The author takes into consideration that, for practical reasons, any x-ray therapy unit will be more or less obsolete after from 12 to 15 years.

ERNST A. SCHMIDT, M.D.

Experiments with a Condenser Discharge X-ray Tube. K. H. Kingdon and H. E. Tanis, Jr. *Physical Rev.*, 53, 128-134, Jan. 15, 1938.

A tube with a 4.5 cm. tungsten disk anode and a pool of mercury for cathode permitted condenser discharges of several hundred amperes at 105 kv., lasting about four microseconds. Each shot yielded about 3.5 r at 11.5 cm. distance.

At this rate, about 40,000,000 r per min., they found Victoreen r meter readings incorrect because of recombination of ions. They found a photographic film about equally blackened by 0.3 r whether delivered in five microseconds or by discharge of the same condenser

through a Coolidge tube at one ma. current. A difference in biologic effect (wheat seeds, *Drosophila* eggs, *Aspergillus* spores) could not be demonstrated. Some arguments in regard to columnar and volume density of ions in relation to biologic effect are presented.

R. R. NEWELL, M.D.

Presentation of Several Pulmonary "Biotomes" Taken with the Apparatus of Bocage. Léon-Kindberg and L. Gérard. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 217-221, April, 1938.

Several cases are presented illustrating the value of radiographs of single planes of the thorax. The authors have had excellent results with the apparatus of Bocage, having taken over 900 films with uniformly successful results.

S. R. BEATTY, M.D.

The New Siemens Body Cavity X-ray Tube with Pointed Anode. Zimmer. *Strahlentherapie*, 62, 731, 1938.

The author describes a new x-ray tube with a pointed anode suitable for insertion into body cavities. This construction permits contact irradiation. Two illustrations of the new tube are shown as well as two isodose curves. Since the dosage measurements for this type of tube are somewhat difficult, calibration curves are furnished by the manufacturer. At a distance of 2 cm. the output is approximately 70 r/min.

ERNST A. POHLE, M.D., Ph.D.

The Biotome: Presentation of the Apparatus. M. A. Bocage. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 210-216, April, 1938.

The biotome is an apparatus designed to secure radiographically views of a single anatomic plane of a subject, the plane being parallel to the film, by means of a simultaneous circular motion of the tube and film in opposite directions during the exposure.

At about the height of the eye the tube is fixed to a connecting rod joining the rims of two identical vertically mounted wheels. The wheels are also connected by a belt which is in turn connected to an electric motor. The axis of one wheel is prolonged as a shaft which transmits, by means of a crank at its end, a rotary motion to a frame holding a cassette at the other end of the apparatus.

The cranks moving the tube and cassette are at an angle of 180 degrees to each other. The tube moves in a circle of 40 cm., the cassette describes a circle varying from 4 to 8 cm. The focal film distance is 140 cm.

The plane of the cassette is maintained parallel to the plane of rotation of the tube.

The distance from the plane of the subject to the film varies from 12.7 cm. to 23.3 cm. This distance is maintained by a perpendicular radiolucent support against which the subject, seated between the tube and film, is placed. This support and the seat can be moved up and down, and also toward or away from the film, a graduated scale determining the proper distance so

that the desired plane of the body is at the required distance from the film.

The exposure is made while the tube and cassette are rotating at the rate of about two turns per second. The exposure time varies from one-half to several seconds and should correspond to an even number of turns of the moving system.

The thickness of the stratum which is not blurred out and is, therefore, seen clearly is about 2 mm.

The circular motion has distinct advantages over a rectilinear motion and is much easier to accomplish than the theoretically superior spiral motion. The circular shadow produced in the center of the film cannot be confused with the shadow of any organic structure and is usually not noticeable.

S. R. BEATTY, M.D.

The Problem of "High Current" X-ray Apparatus. C. H. Esser and P. Ott. *Strahlentherapie*, 1938, 62, 380.

Under high current x-ray apparatus the author understands a machine operated at 200 kv. and 15-30 ma. tube current. He describes his measurements of the quality, output, and depth doses carried out on an apparatus of this type. It is concluded that the main advantage of this type of x-ray apparatus lies in the fact that a high output is available, permitting treatments at long focal skin distances with a higher depth dose in a time short enough to avoid discomfort to the patient.

ERNST A. POHLE, M.D., Ph.D.

Electrostatic Generator Operating under High Air Pressure—Operational Experience and Accessory Apparatus. D. B. Parkinson, R. G. Herb, E. J. Bernet, and J. L. McKibben. *Physical Rev.*, 53, 642-650, April 15, 1938.

Improvements and experience with the Wisconsin electrostatic generator (van de Graaf type) and multi-section tube are described (*Physical Rev.*, 51, 75, 1937). Operating under eight atmospheres air pressure with C Cl_4 or $\text{C Cl}_2\text{F}_2$ vapor, they reach about 2.5 million volts. They are being used for acceleration of positive ions, not for x-ray.

R. R. NEWELL, M.D.

A Simple Procedure for Radiography of the Optic Canal. A. Bardy. *Bull. et mém. Soc. de Radiol. Méd. de France*, 8, 107, 108, February, 1938.

The author secures radiographs of the optic canal simply, by so positioning the patient radioscopically that the shadow of the tip of the nasal bones lies in the center of the opposite orbit.

S. R. BEATTY, M.D.

The Greinacher "Spark" Counter for the Measurement of Very Small Quantities of Roentgen and Radium Rays. A. Leichti. *Strahlentherapie*, 1938, 62, 343.

The author describes the Greinacher "spark" counter and its adaptation to the measurement of very small

quantities of roentgen rays and radium. The differences in construction between this counter and the well-known Geiger counter are mentioned. The sensitivity of the apparatus is so high that 10^{-5} r/second corresponds to approximately 150 quanta/minute.

ERNST A. POHLE, M.D., Ph.D.

ARTHRITIS

Chronic Arthritis of the Shoulder. John G. Kuhns. *New England Jour. Med.*, 219, 516-520, Oct. 6, 1938.

In a review of 1,765 cases of atrophic arthritis the author found 165 with shoulder involvement, and in 641 cases of the hypertrophic form, the shoulder was involved in 42 cases. Symptoms and clinical findings are discussed.

Roentgenographic findings are late. In the atrophic form there is atrophy of the bone together with disappearance of the articular cartilage. Calcification may appear in the articular cartilage. The hypertrophic form is characterized by osseous proliferation. Areas of absorption resembling cysts are sometimes seen in the head of the humerus. Often the most extensive changes are seen in the acromioclavicular joint.

JOHN B. MCANENY, M.D.

A New Surgical Procedure in Acute Infectious Arthritis. Herbert E. Hipps. *Texas St. Jour. Med.*, 34, 276-284, August, 1938.

Acute infectious arthritis, the author believes, is a primary hematogenous osteitis of the epiphyseal end of a bone, generally streptococcal, which spreads to the hyaline cartilage lining the end of the bone and then into the joint cavity. Clinical, laboratory, pathologic, and roentgenographic evidence is given to support this contention.

The treatment advocated, in early cases, consists of draining the bone near the acute arthritic joint by means of drill holes into the bone, using a drill of from $\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter. No drains are used and a plaster cast is applied immediately for immobilization. Care is taken to avoid entering the joint, and, in children, penetration of the epiphyseal line is also avoided since it results in shortening of the limb.

Sixteen cases of acute non-articular inflammation are reported in which this operation was done. Sero-sanguineous fluid under pressure was obtained in early cases. Cases gave excellent results as early as from three to twelve days and positive cultures. The temperature dropped rapidly, pain left within one week, and the joint was practically well without pain or stiffness in from three to four weeks. Results in cases of longer standing were less satisfactory.

Included also are 12 cases of osteoperiosteitis of the os calcis similarly treated in order to hasten recovery. The observation, by the author, that a large number of cases of arthritis gave a history of painful heel (88 out of 137) suggested to him that the condition was primarily an osteitis, and led to the development of this operation.

JOHN M. MILES, M.D.

BACKACHE

Orthopedic Aspects of Pain in the Lower Back. Louis W. Breck. *Southwestern Med.*, 22, 1-4, January, 1938.

Of all types of low back pain, affections of the lumbosacral and sacro-iliac areas are the most important lesions, largely because they are the most common. The causes may be either strain or infection. Pain in the morning and with change of weather is due, usually, to an arthritis. Pain at the end of the day is due to a chronic strain.

In lumbosacral lesions flexion of the lumbar spine is limited in all directions. Spasm of the muscles may cause a twist of the spine, and there is tenderness in the lumbosacral region. X-rays may be negative or may show facet changes, bridging of the ligaments, osteophytes, or narrowing of the lumbosacral intervertebral space.

Sacro-iliac pathology reveals tenderness over the affected joint, limitation of straight leg-raising, and muscle spasm which may amount to a sciatic scoliosis. The x-ray may show marginal sclerosis, true hypertrophic arthritis, or bridging of the ligaments. It is possible to have involvement of both these areas, especially with arthritis.

Other causes of backache include postural conditions, fracture, posterior protrusion of the intervertebral disk, tuberculosis, typhoid spine, osteomyelitis, senile osteoporosis, spondylolisthesis, hemangioma, giant-cell tumor, osteogenic sarcoma, myeloma, metastatic carcinoma, intraspinal tumors, and gynecologic pathology.

The treatment of lumbosacral and sacro-iliac lesions in the acute stage consists of complete bed rest on a hard bed, heat, strapping, and traction to both legs. In chronic cases limitation of activity, heat, and a belt are advised. Foci of infection should be eliminated. X-ray therapy to the affected joint is often useful. If conservative treatment fails operative fusion of the affected joint may be indicated.

M. JOHN MILES, M.D.

BIOLOGIC EFFECTS OF RADIATION

Radiosensitivity and Cell Division. W. Luther. *Strahlentherapie*, 62, 436, 1938.

The author exposed frog eggs immediately after fertilization at intervals of 6, 10, and 15 minutes for five or six minutes to radium rays at the rate of 20 r/min. By plotting a death curve for all eggs injured before the gastrula stage, it appeared that with exposures at intervals of 15 minutes at 20° C. the death curve is very similar to that obtained for roentgen rays at 11° C. The sensitivity of the irradiated eggs is apparently dependent only on the stage of mitosis. The absolute age of the germ during the first four or five divisions has no influence on the reaction to irradiation. Immediately after the first division the susceptibility of the eggs is very low. In the prophase of the next division it increases, drops again during or shortly after the meta-

phase to a second minimum. This same phenomenon was also seen in irradiated eggs of the sea urchin. During the telophase the susceptibility reaches its peak but drops immediately after. Eggs which survive the gastrula stage show disturbances in growth and necrosis. There is considerable individual variation in this reaction because some eggs show no change at that stage, while others are severely injured.

ERNST A. POHLE, M.D., Ph.D.

The Biologic Effect of Roentgen Rays. J. A. Crowther. *Strahlentherapie*, 62, 569, 1938.

This is the text of the twentieth Silvanus Thompson memorial lecture presented before the annual meeting of the British Radiological Society on Dec. 10, 1937. It is reprinted in English in the *British Journal of Radiology*, 11, 123, 1938.

ERNST A. POHLE, M.D., Ph.D.

BONE DISEASES (DIAGNOSIS)

Puffy and Cystic Appearance of the Lower Jaw of a Senegalese. Castay. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 280-282, April, 1938.

The jaw of a Senegalese soldier, which had been increasing in size for two years, was shown roentgenographically to have a soap-bubble, cystic appearance without periosteal rupture or proliferation. The other bones of the skeleton were not involved. The author believes the condition to be a localized osteitis fibrosa cystica.

S. R. BEATTY, M.D.

Osteoporosis in Hyperthyroidism. Elmer C. Bartels and Gilbert E. Haggart. *New England Med. Jour.*, 219, 373-378, Sept. 15, 1938.

The authors bring to notice once more the osteoporosis occurring in hyperthyroidism. The condition usually manifests itself only after the hyperthyroid state has existed for some time. Necropsy shows gross osteoporosis and microscopically there is extensive osteoclastic resorption. Roentgenographically the changes are easily seen. Two cases of fracture occurring in elderly patients are presented. The degree and rate of decalcification depends on the duration of the disease, the rate of calcium loss, and calcium intake.

JOHN McANENY, M.D.

Brodie's Abscess and its Differential Diagnosis. James F. Brailsford. *British Med. Jour.*, 119-123, July 16, 1938.

The author gives an account of Brodie's first description of chronic abscesses in the tibia, in eight patients, one of whom had an amputation after 12 years of suffering. The specimen showing a typical cavity about the size of a walnut.

In analyzing his own series of 42 cases he makes the following conclusions: incidence, male to female—2 : 1; age period, 11 to 30 years, and symptoms are

intermittent with long remissions. One-third of the lesions were in the lower end of the tibia, the epiphysis being perforated only rarely; eight cases had a history of bone injury preceding symptoms. Symptoms are insidious as compared with those of acute osteomyelitis.

Roentgenographic signs vary with the duration and intensity of the lesion. The more indolent the course, the more typically cystic is the cavity. The more acute the course, the less well defined and the larger is the cavity. Roentgenographic localization is essential before surgery. The cavity will persist two or three years after evacuation. Differential diagnosis must be made with consideration of tuberculous abscess, gumma, simple bone cysts, osteoclastoma, sarcoma, and endothelial myeloma.

Q. B. CORAY, M.D.

Primary Hemangioma Involving Bones of the Extremities. Charles F. Geschickter and I. H. Maseritz. *Jour. Bone and Joint Surg.*, 20, 888-900, October, 1938.

Uncommon as this condition is, the number of reported cases is rapidly mounting, and to that number four cases are here added. The similarity between giant-cell tumor and hemangioma of bone is noted and the differential features are stressed. Both conditions show trabeculations but those of the hemangioma are coarser. The hemangioma often shows a punched-out area in the bone beyond the main defect. Biopsy is imperative because of the malignant nature of some of these growths.

JOHN B. McANENY, M.D.

Generalized Form of Paget's Disease with Diffuse Involvement of the Small Bones of the Extremities. P. Harvier, J. Mallarmé, and Guy Ledoux-Lebard. *Jour. de radiol. et d'électrol.*, 22, 60-65, February, 1938.

The authors report a case of Paget's disease with generalized involvement, including many of the small bones of the foot and hand. The lesions of the skeleton are described in detail. The lesions of the phalanges seemed to involve chiefly the epiphyseal portions where they produced the appearance of parallel lines, as of a grill.

S. R. BEATTY, M.D.

BREAST CANCER

Chronic Mastitis and Breast Cancer: A Family History of Five Sisters. W. Sampson Hadley. *British Med. Jour.*, 113-116, July 16, 1938.

The author gives the history of five sisters, descendants of a cancerous mother and grandmother, who have been under his care for 19 years. All sisters had radical breast amputations. Two had simple mastectomies. Two of the sisters have died of breast cancer; the other three are now well. In advising the family he was guided by the following conditions: (1) chronic mastitis is a precancerous condition; (2) chronic mastitis is often amenable to x-ray treatment without oper-

ation and consequently deep x-ray treatment may be an effective prophylactic against cancer; (3) protection by x-ray is neither absolute nor permanent and cases so treated should be re-examined every three to six months; (4) cases of chronic mastitis in immediate danger of cancer present recognizable peculiarities, and (5) breast cancer should be treated by radical operation, with radium to the internal mammary glands and subsequent moderate prophylactic x-ray treatment.

The author states that the results of this experience offers encouragement to his belief that routine mastectomy for chronic mastitis can be safely rejected in favor of x-ray treatment with periodic examinations. It is apparent in the case histories that the sisters who received x-ray therapy systematically for mastitis did not require operation until a number of years had elapsed. Each of these cases of breast cancer was preceded for a long time by simple mastitis. This condition was kept in control in one case for 14 years before danger signals indicated surgery.

Q. B. CORAY, M.D.

Vertebral Metastasis from Carcinoma of the Breast Treated by Teleroentgentherapy. André Poulain. *Bull. et mém. Soc. de Radiol. Méd. de France*, 8, 100, 101, February, 1938.

Twenty-three years after radical resection of the breast metastasis appeared in the vertebræ and pleura. Teleroentgentherapy, following the failure of local roentgen therapy, caused regression of the pleural thickening and exudate and some recalcification of the bone lesions with loss of pain and general improvement maintained (skin) for over a year. The patient was given 650 r in 26 treatments over a period of six weeks followed after two and four months by series totaling 300 r. *Technic:* 180 kv.p., 4 ma., 0.5 mm. Cu + 2 mm. Al, 150 cm. F.S. D., fields 40 × 40 cm. two anterior and two posterior.

S. R. BEATTY, M.D.

BRONCHOSCOPY

Phases of Bronchoscopy and Esophagoscopy of Importance in General Practice. Virgil J. Schwartz. *Minnesota Med.*, 21, 601-607, September, 1938.

Schwartz points out that whereas bronchoscopy and esophagoscopy once had for their principal utility the removal of foreign bodies, they now play important rôles in the diagnosis and treatment of primary carcinoma of the bronchi, malignancy of the esophagus, lung abscess, tuberculosis, diphtheria, bronchiectasis, and tracheal stenosis or displacement due to thyroid enlargement, mediastinal gland involvement, or aortic aneurysm. Also to be considered are cicatricial stenosis, scleroma, asthma, unexplained vomiting of blood or regurgitation of food, and atelectasis due to thick lung secretions.

Any unexplained interference with the function of swallowing, or of the stomach, an unexplained cough, dyspnea, hemoptysis, and expectoration call for appropriate investigation.

One patient with lung malignancy who had complained of symptoms for one year showed nothing but fluid in the base on roentgenographic study, and the diagnosis was made by bronchoscopy.

Cancer of the esophagus occurs in male patients most frequently in the middle third, next in the lower third, and least often in the upper third. In female patients, it is most frequent in the upper end.

Unexplained vomiting of blood may be due to an ulcer of the esophagus, which will often elude all forms of investigation but esophagoscopy.

Grasping a child by the feet and holding him upside down while trying to have him cough out a foreign body may have fatal results. In one of the author's cases in which this had been done, an acorn was found firmly wedged in the subglottic space and between the vocal cords. This acorn, previous to the manipulation employed by the child's parents, had been lodged apparently in one of the main bronchi.

In cases of diphtheria which appear terminal through obstruction to breathing, removal of the obstructing membrane by forceps or suction may result in recovery.

Bronchiectasis may frequently be prevented by repeated aspiration of residual pus in the lungs or bronchial tree—the result of an acute suppurative inflammation in this area.

An x-ray examination is advised in all foreign body cases, since there may be more than one foreign body. In closing, the author gives several cautions, among which are the following: never allow the age of the patient to influence diagnosis unduly; never leave thermometers in the mouths of unattended children; never practise "blind bouginage"; never diagnose "nervous" conditions in the esophagus without endoscopic examination; always repeat x-ray examination if a known foreign body cannot be found; always be prepared for tracheotomy; always be on guard for non-opaque foreign bodies in the chest.

PERCY J. DELANO, M.D.

CALCULI

Non-operative Management of Remaining Common Duct Stones. R. Russell Best and N. Frederick Hicken. *Jour. Am. Med. Assn.*, 110, 1257-1261, April 16, 1938.

The making of immediate cholangiograms at the operating table and delayed studies in all cases of common duct drainage or biliary fistula has added inestimably to the knowledge of the pathologic physiology of the extrahepatic biliary tract. The authors have used a 48 per cent solution of hippuran as a matter of routine with gratifying results. They found that delayed cholangiograms frequently revealed stones or foreign bodies such as blood clots, organized débris, or inspissated bile in common ducts, which were thoroughly explored by palpation, probing, scooping, irrigation, and suction at the time of operation.

The first problem is to provide a free exit at the lower end of the common duct through which the foreign elements may pass into the duodenum. The authors have observed, with the aid of cholangiograms, that

magnesium sulfate on the duodenal side of the choledochal sphincter assists the contents of the common duct to pass more freely into the duodenum. They have also reported on the apparent soothing or relaxing effect of warm olive oil or iodized oil when applied to the choledochal side of the sphincter of Oddi through a T-tube or fistula. The second step in dislodging the foreign body is increasing the pressure behind it. This is easily accomplished by injecting saline solution, olive oil, or iodized oil through the drainage tube or fistula if the foreign body is below their level. If these smaller particles are lodged above the opening of the tube or fistula, they may be forced higher into the hepatic duct or into the larger biliary radicles within the liver. Again, after these higher stones are once dislodged, they may find their way down to the lower end of the common duct. It is also conceivable that increasing the flow of bile by stimulating its formation will augment the intraductal pressure. The flow of bile and the intraductal pressure are heightened after administration of either decholin or procholol, the commercial products of dehydrocholic acid. This added pressure is of greatest value when the foreign body is below the inlet of the T-tube, catheter, or fistula in the common duct, as it tends to force the impediment through the sphincter during some momentary period of relaxation.

The dehydrocholic acid products should be cautiously prescribed when there is any degree of jaundice with supposition of stone in the common duct. If the jaundice is marked, with acholic stools, great damage might be done to the liver, and dehydrocholic acid should definitely not be prescribed.

CHARLES G. SUTHERLAND, M.D.

A Large Calculus of the Gall Bladder with Suppuration. E. Binet and Dillenseger. *Jour. de radiol. et d'électrol.*, 22, 66, February, 1938.

The authors present the radiograph of an enormous gallstone (5 × 4 cm.). At operation, the gall bladder was found to be covered by adherent organs and to be the seat of a large abscess. The center of the stone itself was softened and necrotic.

S. R. BEATTY, M.D.

A Brief Review of 426 Consecutive Cases of Urinary Calculus. H. P. Winsbury-White. *British Med. Jour.*, 1204, 1205, June 4, 1938.

The author makes the rather noteworthy statement that renal calculus was previously nothing compared with what it is to-day. The wave of urinary lithiasis began about 1924, and the increase has been in some localities as high as 1,000 per cent.

At present urinary calculi occur twice as often in males as in females and 79 per cent of the stones are in the upper tract. Chronic staphylococcal infections of the genitalia are predisposing factors. The great majority of ureteral calculi pass spontaneously. After instrumentation, observation should be made regularly by x-ray—either plain plate or intravenous urography.

It is abundantly clear that urinary lithiasis which manifests itself as a deficiency disease is vesical rather than renal. Fifty years ago this condition was common among poor children. Now it occurs mainly in men past 50 years of age.

Q. B. CORAY, M.D.

CANCER (DIAGNOSIS)

Results of Radiation Therapy in Carcinoma of the Hypopharynx. E. Bandhauer. *Strahlentherapie*, 62, 705, 1938.

From 1932 to 1936, the author observed 92 cases of carcinoma of the hypopharynx. Eleven of these were in too advanced a stage to be treated, one was operated upon, 18 were treated by radium, 19 by a combination of x-rays and radium, and 43 by x-rays only. Fifty-nine cases could be treated completely and 40 of these were available for the follow-up. At the end of three years there were 20 per cent and at the end of five years there were 17 per cent alive and free from symptoms. The author did not use the original method of Coutard but a modified technic based on a method described by Holfelder.

ERNST A. POHLE, M.D., Ph.D.

Primary Carcinoma of the Lung. Max O. Klotz. *Am. Jour. Med. Sci.*, 196, 436-454, September, 1938.

As late as 1922, primary carcinoma of the lung was considered a rare disease. At the present time, its incidence is third among all malignancies.

Whether the increased frequency is actual or apparent is as yet undecided, nevertheless, this condition is seen more commonly now than formerly. The many factors responsible for the increase are the lengthened span of human life, the increased interest in the disease, the improved diagnostic procedures and equipment, the hope of carrying out successful operative treatment, and the marked improvement in the ability of the pathologist to recognize the disease.

All of the cases are probably of bronchial origin. Although a gross classification, disregarding cell type, is undesirable, it is usual to group the cases as the hilar infiltrating type, the nodular form, and the diffuse variety. The hilar infiltrating type, which forms the great majority of the cases, tends to form large masses about the lung root, with ulceration and stenosis of the bronchi, and massive involvement of the lymph nodes. The nodular form, which is uncommon, assumes a peripheral circumscribed appearance. The diffuse form, which is also infrequent, simulates a pneumonic consolidation or interstitial fibrosis.

The difficulty in classifying pulmonary cancers in relation to cell types arises from the fact that there is usually little resemblance between the tumor cells and the normal pulmonary structures. The bronchial lining cells probably give rise to these tumors.

About 40 per cent of the cases are those of an undifferentiated growth, while 30 per cent are of the cylindrical cell group and an equal number are of the epidermoid type. The first group consists of those

showing oat cells and spindle cells, and were formerly called sarcomas. The cell of origin is impossible to determine. The cylindrical cell variety, forming the adenocarcinomas, probably arises from the bronchi, while the epidermoid type probably originates through metaplasia of bronchial epithelium.

The most satisfactory classification is that depicted by a "Y," the stem being the anaplastic form, and the two arms representing differentiation toward the cylindrical and the epidermoid cell types, the highest degree of differentiation.

Bronchial cancers are notorious for the frequency and the diffuse spread of their metastases—almost every organ having been recorded as a site for the secondary deposits. The highest incidence of extra-thoracic metastases occurs in the cervical lymph nodes, kidneys, adrenals, bones, brain, pancreas, and thyroid, in about that order. Samson contends that the adenocarcinomas show a special predilection for the central nervous system, kidneys, adrenals, and both lungs, probably due to hematogenous spread. The undifferentiated cell variety tends toward excessive lymphogenous spread, with invasion of the pancreas, liver, and spleen, while the epidermoid type involves chiefly the peribronchial lymph nodes.

Etiologically, these tumors are probably governed by the same laws that govern the development of carcinomas elsewhere. Climate appears to have little influence. The white race is predominantly affected. The peak incidence occurs between the ages of 50 and 60. It is relatively uncommon in females. Except for the miners of Schneeberg and Joachimstal, no industrial correlation has been found, although silicosis may be an important predisposing influence. Chronic irritation, particularly inflammation of the respiratory tract, is of the greatest possible significance. No hereditary factor for humans has been demonstrated as yet in carcinoma of the lung. Fischer-Wassels suggests the following sequence of events; hereditary predisposition, irritation, repair with excessive proliferation, and finally, malignancy.

BENJAMIN COPELAN, M.D.

Urinary Prolans in Cancer Cases. E. Harvey. *Irish Jour. Med. Sci.*, 151, 328-339, July, 1938.

With a broad discussion of the urinary prolans and their interrelations, together with their relation with carcinogenic hydrocarbons, the author opens his demonstration of the inability to correlate the urinary prolans concentration with the occurrence of cancer. The extensive investigation is of importance for its negative value.

JOHN MCANENY, M.D.

Primary Bronchogenic Carcinoma from the Pathologic and Radiologic Points of View. Walter L. Matlack and Eugene M. Burke. *Jour. Am. Med. Assn.*, 109, 2121-2124, Dec. 25, 1937.

In their series of 30,000 patients with 18,000 malignant growths there were 73 cases of carcinoma of the

bronchus (1 in 250). At postmortem examination this lesion was noted with half the frequency of carcinoma of the stomach. The greatest prevalence was noted between the ages of 40 and 70 years, the lesion being most common in the fifth decade.

Metastases were most frequent in the bones (38 per cent) and involvement of distant nodes was slightly less frequent (36 per cent). Extension to adjoining lobes or to the contralateral lung or regional nodes occurred with approximately the same frequency as distant metastases. These metastases or extensions were tabulated.

Only by the development to detect bronchial carcinoma, and the use of serial roentgenography in all cases in which the history is suggestive can the clinician or radiologist be led to the early recognition of the lesion.

The most common roentgen characteristics were atelectasis in the hilus, or central type, and tumor in the peripheral type, which was found in only 11 per cent of the cases of their series.

CHARLES G. SUTHERLAND, M.D.

Practical Ideas Concerning Cancerology Indispensable to the Practitioner. R. Reding. Bruxelles-méd., 18, 933-943, May 22, 1938.

There is, among general practitioners, an unjustified pessimism concerning the prognosis of cases of cancer, an ignorance of the carcinogenic properties of certain commonly used medications, and of the etiologic importance of certain occupations and habits of living. Wider appreciation of the favorable results of present-day treatment of cancer would dispel much of this pessimism. The author has, in this paper, discussed briefly but rather completely the rôle of tar, petroleum derivatives, oestrin and folliculin, arsenic, and radioactive substances in the production of cancer. The employment of large doses of the vitamins is not without danger, in cancer cases particularly.

Chronic infection has a definite rôle in the etiology of cancer. Biopsy entails the danger of the spread of metastasis and should be done, if necessary, after preliminary irradiation, and the electric knife should be used. Immediate microscopic examination should be followed by the appropriate therapy. States of malnutrition undoubtedly favor the occurrence of neoplasms as does the absorption of indol from intestinal putrefaction. Tobacco is dangerous because of the hydrocarbons liberated in its combustion.

Occupational cancer occurs in those industries in which petroleum products, aniline dyes, arsenic potassium bichromate, and radio-active substances are employed.

S. R. BEATTY, M.D.

CANCER (THERAPY)

Roentgen Therapy. L. S. McAlister. Jour. Okla. St. Med. Assn., 31, 161-164, May, 1938.

This is a discussion along general lines of the wide

range of x-ray therapy, with mention of the various techniques employed by the author and other roentgenologists. Excellent results are obtained in over 90 per cent of the cases of malignancy of the skin regardless of the quality of the ray used, provided that the total dose be administered within two weeks.

In addition to malignancy about 80 skin diseases and various acute and chronic infections are now benefited. Among the conditions mentioned are acute adenitis treated with 75 r daily, chronic adenitis 150 r, diphtheria carriers from 75 to 200 r, otitis media from 75 to 100 r, and erysipelas 75 r daily for from two to three days.

The question is raised whether or not good results in some inflammatory conditions are always the result of x-ray therapy, and whether sometimes a less radical form of treatment such as ultra-violet or sulfanilamide is not advisable for erysipelas.

JOHN M. MILES, M.D.

Cancer Campaign: Suggestions for Better Treatment of Malignant Growths. A. M. Begg. New Zealand Med. Jour., 37, 147-153, June, 1938.

In radiotherapy we have a dual effect: (1) the direct lethal action of the rays on the cancer cells, and (2) the stimulating effect on the connective tissue cells which then wall off the remaining cancerous cells, finally obliterating them. Activity on the part of the fibrocytes is essential in the latter process. Too much radiation may destroy this activity by bringing about sclerosis of the fibrocytes and thereby rendering them useless in combating the cancer cells. On the other hand a small amount of radiation may not bring about the direct lethal action desired on the cancer cells. We wish to obtain the maximum of both effects.

To obtain the maximum lethal effect on the cancer cells, we should bring about a state of mitosis and remove as far as possible any sclerotic tissue surrounding the cells so as to re-establish a better vascular supply. To do this latter one may (1) inject fibrolysin; (2) apply Bier's suction glass daily to the site; (3) ionize the cancer with 2 per cent sodium chloride; (4) apply dry heat, or (5) use diathermy. To promote mitotic activity the writer advocates a preliminary starving of the patient for 24 hours, thus holding this activity in abeyance before treatment and the giving of a diet rich in liver and glucose, simultaneously with the beginning of treatment. The giving of x-rays for a prolonged time is advocated, but any sclerotic tissue formed should be removed by the methods mentioned above. After radiotherapy an active fibrocytic response may be induced by the injection of blood, the stimulation of lymphocytosis by the injection of olive oil or oleic acid, and the use of dry heat.

J. PAUL BENNETT, M.D.

Indications and Results of Treatment of Oto-rhinolaryngological Cancer by Radiations. L. Eloy. Bruxelles-méd., 18, 455-458, Jan. 30, 1938.

The method of treatment employed in carcino

the superior maxilla, tonsil, and larynx are briefly discussed. The author prefers surgery and radium in carcinoma of the antrum, surgery in adult tumors of the tonsils when metastases are not present, x-ray and radium in less adult lesions or those with glandular involvement. In carcinoma of the larynx, surgery is indicated except when the tumor involves the epiglottis, the pharynx, or has invaded the lymph glands. X-ray therapy is indicated in undifferentiated carcinoma of the ventricles.

S. R. BEATTY, M.D.

The Prevention and Control of Cancer: A Plan for Nation-wide Organization. J. W. Schereschewsky. *Jour. of Med.*, 19, 358-363, September, 1938.

This plan is based on the Bone Act establishing the National Cancer Institute which co-operates with the State Board of Health in the various States, these latter having a division of Cancer Control. Various localities in each state will have a center for diagnosing and treating malignancies. Each center will care for an area of about 50 miles in all directions.

The State Health Department will bind these various centers together, supply educational features to the laity and the medical profession, and provide diagnostic aid.

The probable cost to the whole nation for this program is estimated to be \$10,000,000 per year.

J. B. McANENY, M.D.

Early Results of Near Distance Radiation in Carcinoma of the Skin and Lip. A. Hrabovszky. *Strahlentherapie*, 62, 691, 1938.

The author reports his experience with the treatment of 120 patients with carcinoma of the skin and lip. Seventy-nine cases had skin epitheliomas distributed over the following regions: frontal area, cheek, nose, ear lobe, eyelid, scalp, remaining skin of the face, body, and extremities. Sixty-two were in the early stage and 17 had indurated the subcutaneous tissue. In all cases the lesion was destroyed by the treatment and a primary cure was obtained. Of the 23 cases of cancer of the lip, 15 were early and eight advanced. All of these patients responded well and primary healing was obtained. A table is presented summarizing the results of seven different clinics, comprising a total of 619 cases of carcinoma of the skin and lip. In 96.2 per cent primary healing was secured. He concludes, therefore, that near distance x-radiation in the treatment of skin and lip cancer is as effective as radium, at least as far as immediate results are concerned.

ERNST A. POHLE, M.D., Ph.D.

THE COLON

Fundamentals in the Surgical Treatment of Colon Disorders. Lawrence M. Larson. *Minnesota Med.*, 21, 617-620, September, 1938.

Larson briefly reviews the anatomy and physiology of the colon, pointing out that there is a definite

bilaterality in the two halves of the colon, right and left, and that the two halves behave differently in function and present different diagnostic problems.

The right half of the colon is thin-walled and absorptive; the left is thicker-walled and not absorptive.

Carcinoma in the right half of the colon is characterized by a marked and inexplicable anemia; beside this, there are usually only vague digestive symptoms.

Carcinoma of the left half of the colon is characterized only by obstructive symptoms in many cases, the general health remaining relatively unimpaired, and no anemia, or only a slight one, being noted. Other symptoms which may appear are flatulence and diarrhea.

In general, malignant lesions of the bowel are slow-growing, metastasize late, and good results may be expected from surgery if done at all early. Metastases were found in only a half, and liver metastases in only a third of 210 patients dying of bowel malignancies.

Roentgen-ray and proctoscopic methods should enable the diagnosis to be made in practically all cases.

The author discusses the surgical attack on various portions of the colon, together with pre-operative and post-operative care.

PERCY J. DELANO, M.D.

A Case of Genuine Invagination of the Colon. Bengt S. Holmgren. *Acta Radiol.*, 19, 135-142, May, 1938.

Cases of genuine colonic invagination on a tumor basis are rare. The number of such cases reported in the literature probably does not exceed 15 (author's case included).

The invagination was observed roentgenologically and confirmed operatively in a 62-year-old man who, for a period of about three months, had experienced almost continuous pain in the entire abdomen. The pain appeared immediately after meals and lasted about fifteen minutes. Examination of the stools was negative. Palpation of the abdomen revealed neither tenderness nor tumor masses. X-ray examination after barium enema during an acute attack of pain showed an invagination of the ascending colon near the hepatic flexure combined with a filling defect, apparently due to tumor, distal to the valvula Bauhini. In addition, sigmoiditis with diverticulosis was observed. Four days after the x-ray examination an ileo-ceco-colic resection and a latero-lateral ileotransversostomy were performed. The post-operative pathological tumor diagnosis was adenocarcinoma. The patient died nine days after the operation of paralytic ileus and chronic myocarditis.

The author stresses the necessity of x-ray examination during the attacks of pain as well as during, and after, the evacuation of the barium enema.

ERNST A. SCHMIDT, M.D.

Prognosis of Diverticulitis and Diverticulosis of the Colon. Philip W. Brown and David M. Marckley. *Jour. Am. Med. Assn.*, 109, 1328-1333, Oct. 23, 1937.

The incidence of diverticula of the colon is approxi-

mately 5.6 to 7 per cent. The rate of diverticulitis to diverticulosis is one to six or eight.

Follow-up data were obtained in 86 per cent of a series of 596 cases of diverticulosis or diverticulitis. In a few cases of simple diverticulitis, complications may develop and require surgical treatment. Medical treatment of diverticulitis consists of rest, the application of heat, regulation of the diet, and the oral administration of olive oil. In 63 per cent of cases this type of treatment was successful. Many of the patients that showed results only fair or poor were able to live in comparative comfort. The relationship between diverticulitis and carcinoma of the colon probably is incidental rather than actual.

CHARLES G. SUTHERLAND, M.D.

Causes and Results of Colospasms. L. Gleize-Rambal. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 82-85, January, 1938.

The causes of colospasm are varied but the author believes that a frequently unregarded factor is the presence of an argentaffin tumor of the intestinal tract, usually located in the appendix. These tumors contain tissue similar to the adrenal and may cause symptoms by secretion of an excess of adrenaline. Removal of an appendix which is the site of such a tumor may relieve the symptoms.

Spasm of the colon results in delay favoring fermentation with production of oxalic acid as one of the chief consequences. Absorption of oxalic acid may produce hypocalcemia, vagotonia hypotension, and hypocalcemic spasmophilia.

A syndrome of alternating delay and acceleration of the passage of material through the colon precedes the appearance of true colospasm which is diagnosed by its constant appearance in several examinations.

The determination of the amount of oxalic acid in the blood, careful study of liver function, and repeated studies of the colon are essential. Physiotherapeutic methods are often valuable in the treatment of syndrome of colospasm.

S. R. BEATTY, M.D.

DENTAL INFECTION

The Diagnosis of Focal (Dental) Infection, Especially by Means of the Roentgenogram. Wolfgang Praeger. *München. med. Wchnschr.*, 85, 1076-1078, July 15, 1938.

The author discusses some of the causes of error in diagnosing dental abscess. The focus may be too small to see; it may be obscured by irregularity of projection of some of the roots, or it may be lost by divergent projection of the beam. Of this last, some examples are cited. The mental foramen is a cause of error.

The question of whether or not a focus is sharply limited may be determined. The appearance depends, however, on a large number of other factors as well. Negative findings are not necessarily conclusive of ab-

sence of infection. Pulp death may also be diagnosed by roentgen examination.

From a therapeutic standpoint, the prevention and care of caries, especially in children, the treatment of caries which have involved the pulp cavity, and the care of infected teeth are important.

LEWIS G. JACOBS, M.D.

THE DUODENUM

Diverticulum of the Duodenum. Digby Wheeler. *Canad. Med. Assn. Jour.*, 39, 214-219, September, 1938.

The author suggests a division of duodenal diverticula into primary and secondary. Primary are those found in the second, third, and fourth portions of the duodenum. They are probably congenital and are most frequently found on the inside of the duodenal loop and are therefore in relationship to the head of the pancreas. An exception is a case, presented by the author, of a large traumatic diverticulum of the lateral side of the second portion of the duodenum. Primary diverticula are often multiple and seen after the fifth decade. The wall is formed by the mucosal and submucosal coats. Secondary diverticula are the result of chronic ulcer and occur only in the first portion of the duodenum. All the coats of the intestine form the wall.

There are no pathognomonic signs or symptoms and the only method of diagnosis is by the barium meal. In an x-ray examination the following points must be noted: (1) size and shape; (2) situation; (3) dimensions and position of orifice; (4) mobility; (5) length of time the barium is retained, and (6) relationship of the shadow to any point of tenderness.

If a diverticulum is the cause of the patient's trouble it is customary to try medicinal treatment before any operative procedure is undertaken. At operation difficulty is sometimes experienced in locating a pouch that has been previously located by x-ray. This occurs especially when the pouch is embedded in the pancreas or is lying dorsal to it.

M. L. CONNELLY, M.D.

Unusual Case of Invagination of the Pylorus into the Duodenum. Liborio Galifi. *Radiol. Med.*, 25, 454-466, May, 1938.

The author reports a case of recurrent intussusception of the duodenum. The clinical history is of especial interest because the location of the pain, melena, and the relief of the pain by alkalies were very suggestive of ulcer.

Roentgenological examination, however, failed to confirm the diagnosis. In the erect position, examination of the cap was very difficult, but a certain flaccidity of this portion of the intestine with a tendency for the bulb to hide within the gastric lumen was noticed. In the roentgenogram the deformity was a dome-like, transparent shadow, adjacent to the pyloric end of the stomach, capped by the triangular (caput-like) shadow of the duodenal bulb. In the prone position the

teriolytic effect either in pus or blood serum. Therefore, the results of treatment do not depend on the sensitivity of the bacteria; rather, the varying sensitivity of different patients explains why different doses have the same effect. There are two methods of treatment: (1) a heavy dose to eliminate the function of the affected organ, and (2) a small dose directed at the inflammation itself.

The reaction of inflammatory tissue to x-rays depends on:

- (1) Acute inflammation is accompanied by polymorphonuclear leukocytes which act like young cells and are highly radiosensitive.
- (2) Chronic inflammation is accompanied by lymphocytes which are less radiosensitive. When connective tissue develops, the dose must be increased because it is only slightly sensitive to x-rays.
- (3) The abundance of blood vessels in the infected part is a factor since the greater the vascularity, the greater the sensitivity to x-rays.
- (4) The innervation of the affected part is another factor because the vegetative nervous system is very radiosensitive.

In conclusion, we have the following methods of treatment:

- (1) Direct attack on the inflammation by small doses.
- (2) Indirect attack by large doses which exclude the function of the organ.
- (3) Direct influence resulting from the local reaction and another resulting from the systemic reaction.
- (4) Between the local and systemic reactions there is a reciprocal reaction.
- (5) Dosage and interval between treatments should be adapted to each specific case.
- (6) X-rays have accumulative effect and an unfavorable reaction or none at all may result if timing is not right.

- (7) If small doses do not produce the desired effect increase the dose.

J. SAGEL, M.D.

THE JOINTS

The Technic of Air Injection of the Joints. Robert Meyer-Wildisen. *Schweiz. med. Wehnschr.*, 68, 991, Aug. 20, 1938.

This brief note describes pneumoradiography of the joints. The author advises injection of from 1.5 to 2.5 c.c. of abrodil (skiodan) plus enough carbon dioxide to fill the joint. In bloody or serous effusions satisfactory results may be obtained without abrodil. The internal structure of the joint and the presence and location of joint mice and foreign bodies can be demonstrated invariably.

LEWIS G. JACOBS, M.D.

Conditions Responsible for the Radiographic Visualization of the "True Joint Fissure." W. Magnusson. *Acta Radiol.*, 18, 733-741, October, 1937.

In 1932, Dittmar reported the possibility of visualizing, without contrast medium, the joint fissure proper and the medial meniscus both in pathologic knee joints of adults and normal knee joints of children. These observations were later confirmed for a number of joints by various authors. Magnusson shows that this phenomenon which appears as a well demarcated dark fissure can be produced experimentally in children either by over-extension of the joint or by traction. In addition, he has observed such fissures in the intervertebral disks in cases of spondylitis deformans, and in the pubic symphysis in pregnancy. With Fick and his collaborators, Magnusson assumes that the phenomenon is probably due to the development of gas in the joint. All investigators agree that the observation is of more theoretical than practical significance.

ERNST A. SCHMIDT, M.D.



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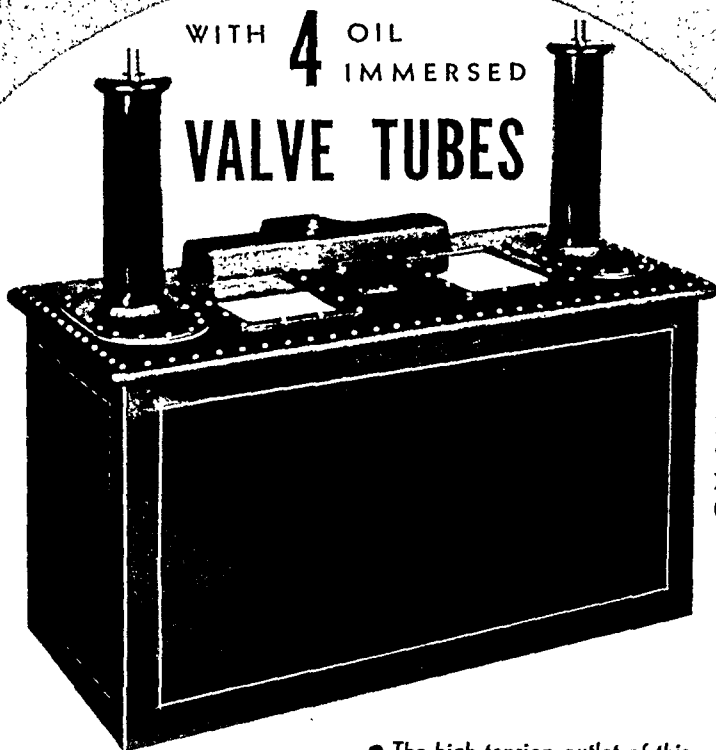
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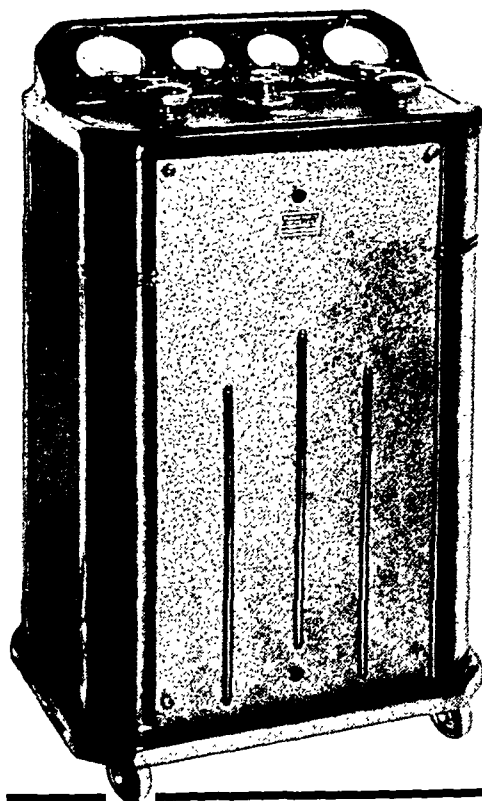


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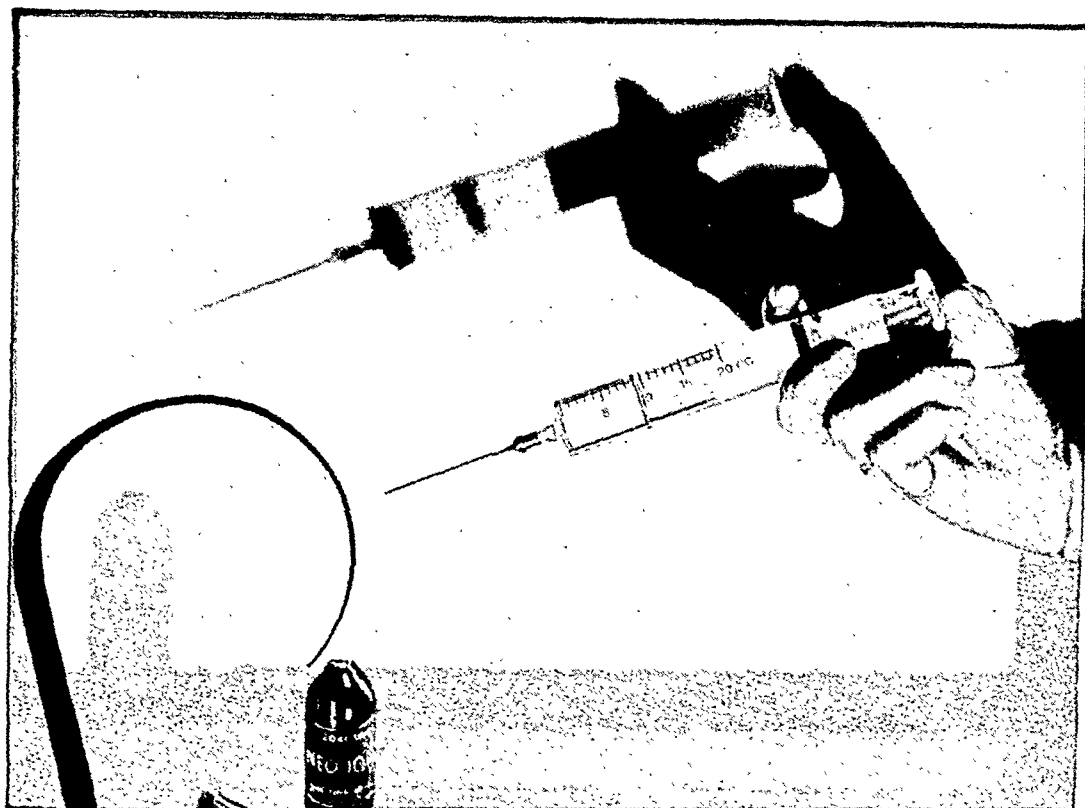
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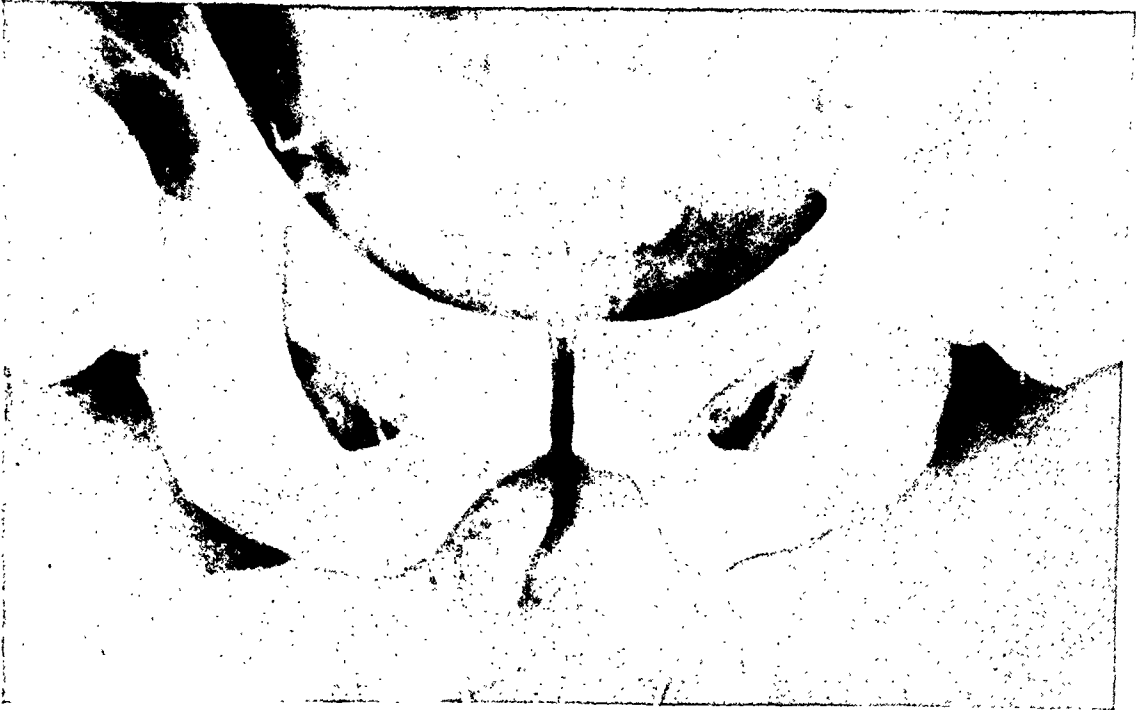
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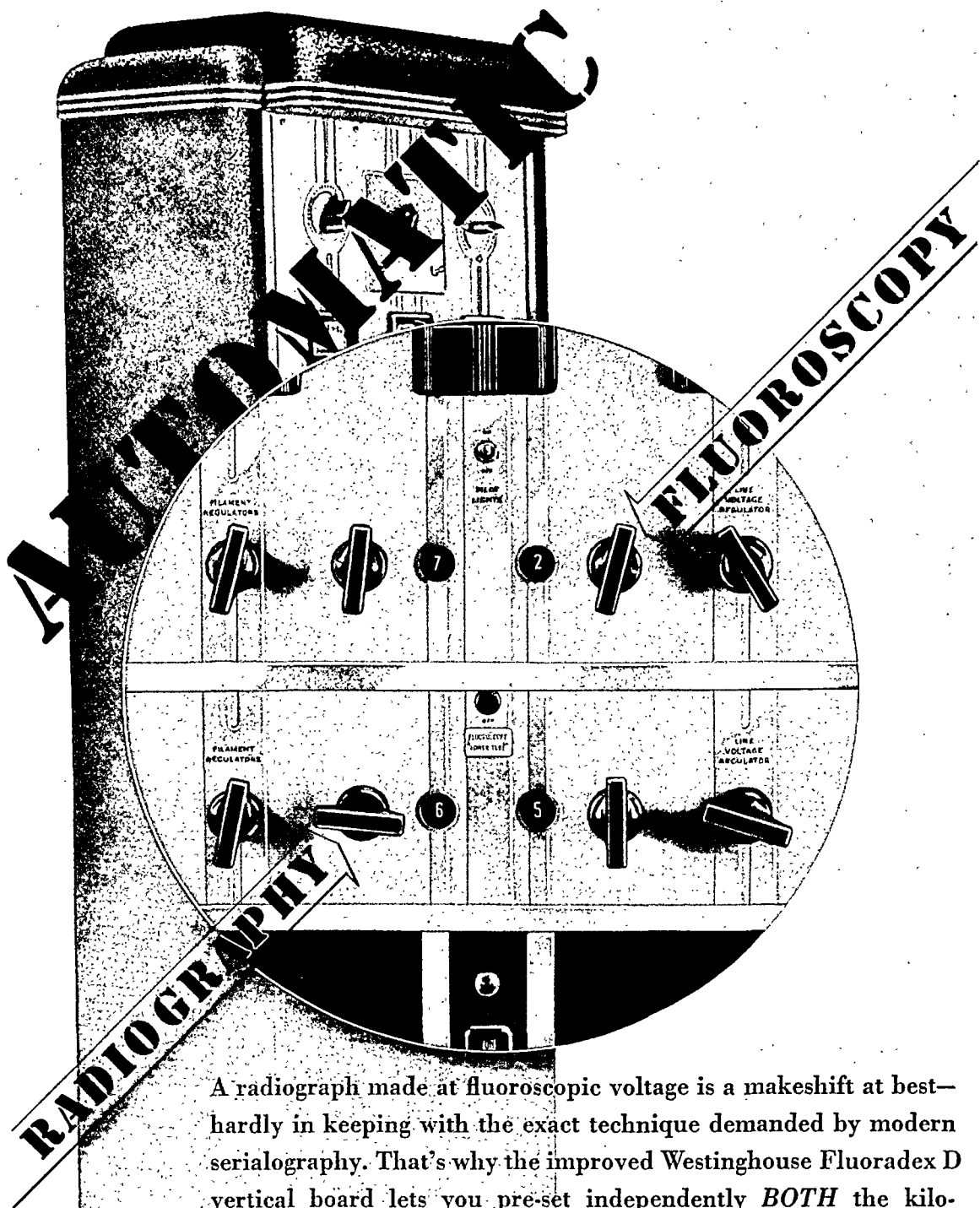
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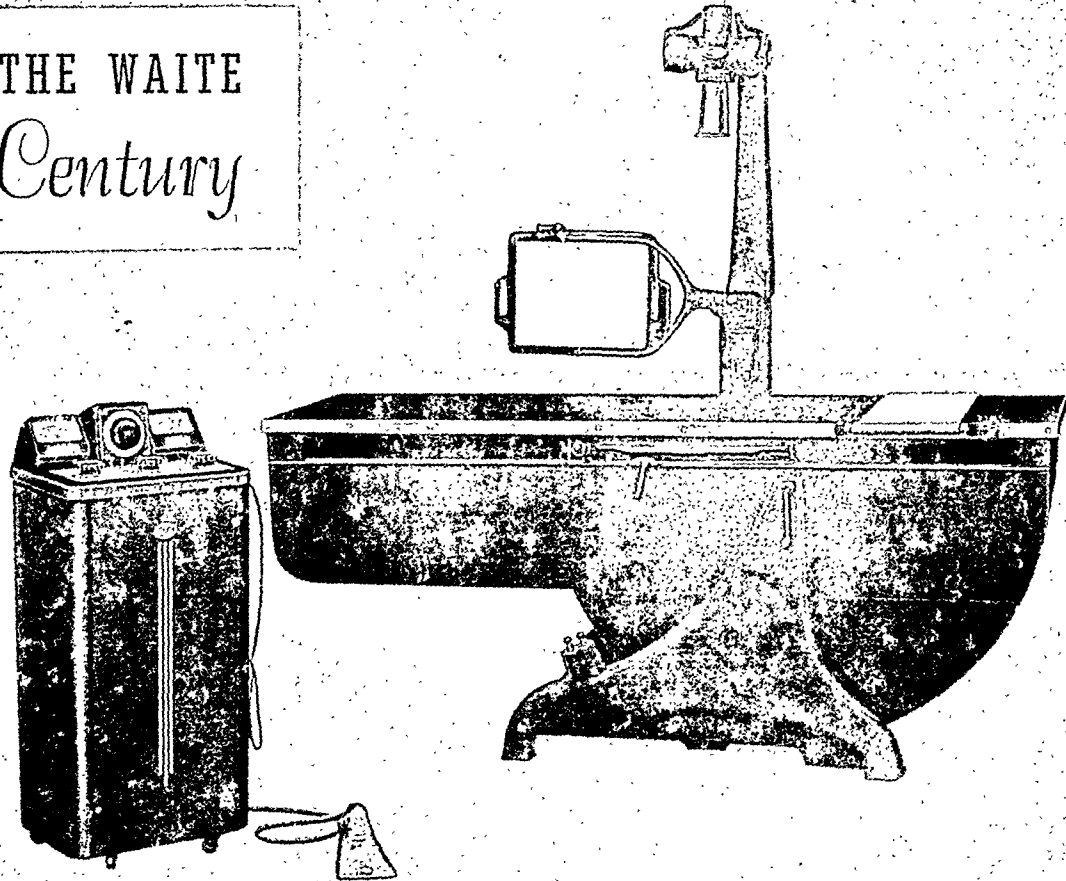
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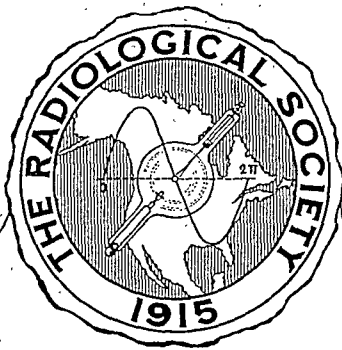
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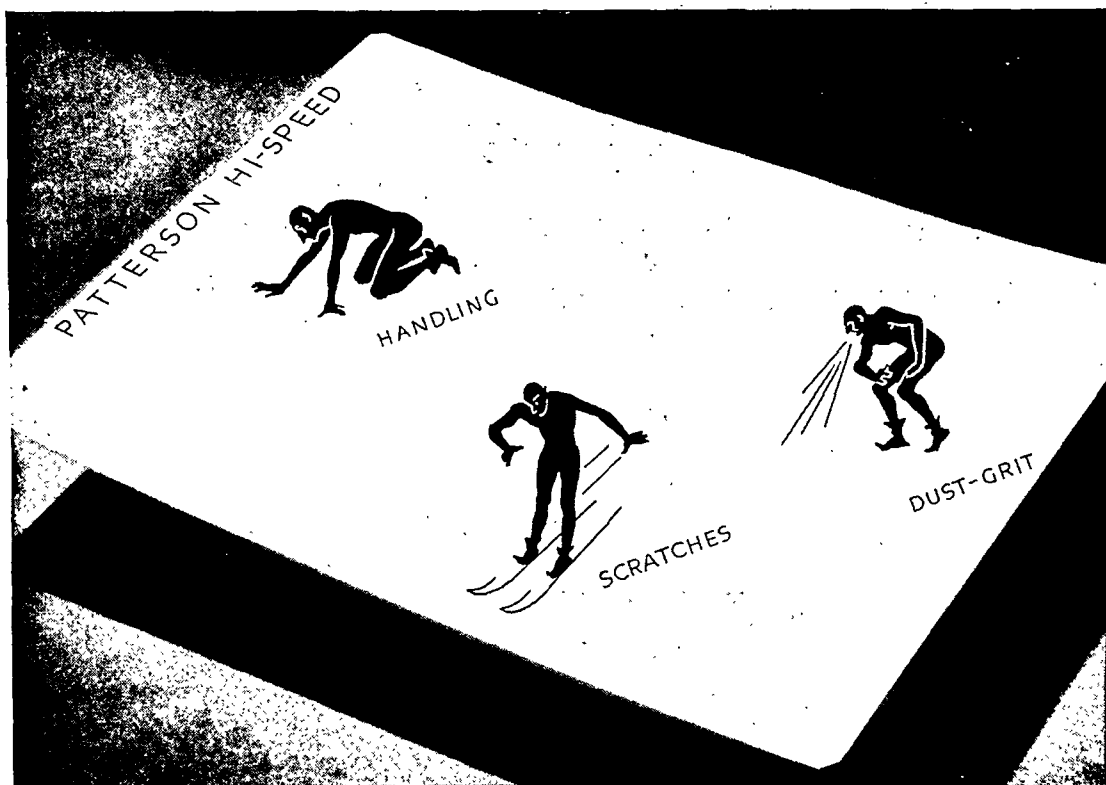
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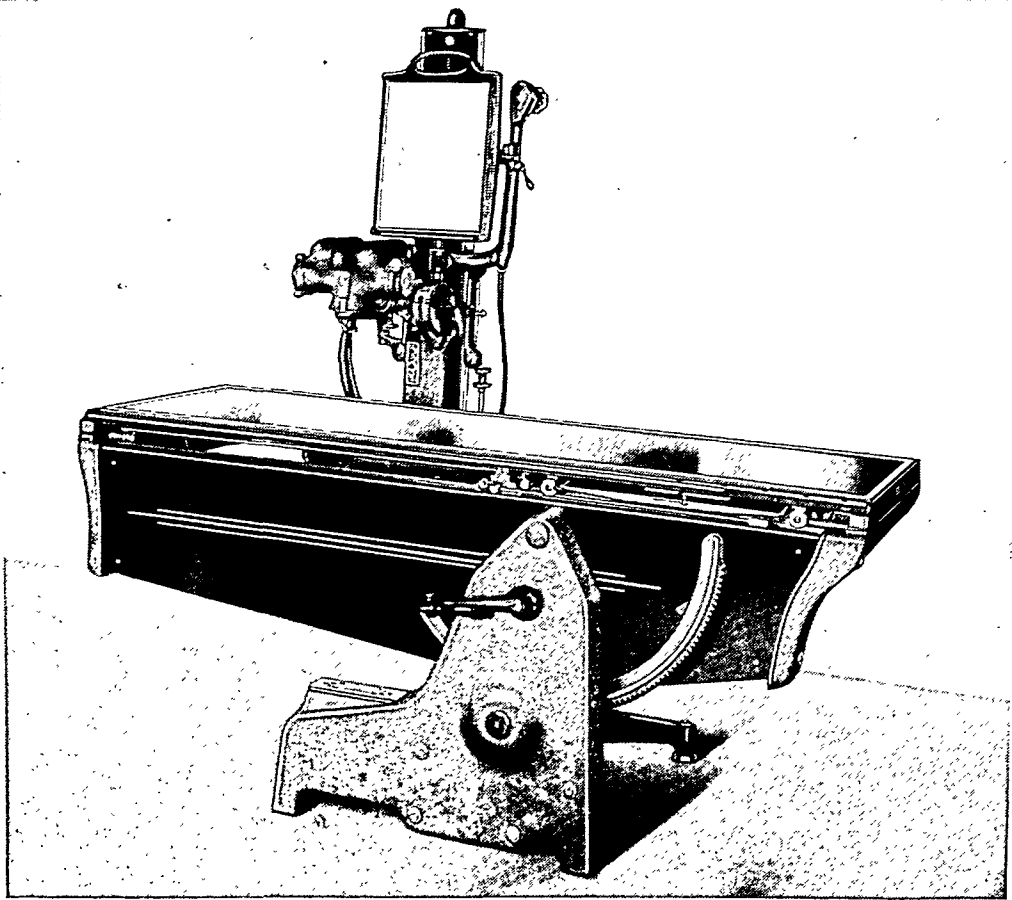
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ROENTGENOGRAPHIC PELVIMETRY AND FETALOMETRY

ELIMINATION OF ERRORS DUE TO MOVEMENTS BETWEEN X-RAY EXPOSURES

By WALTER W. FRAY, M.D., and WESLEY T. POMMERENKE, M.D., Rochester, New York¹

From the Department of Medicine, Division of Radiology, and Department of Obstetrics and Gynecology of the University of Rochester School of Medicine and Dentistry

SEVERAL radically different methods have been proposed for the measurement of the pelvis and fetus, each having its disadvantages, but all possessing merit. Thoms (8) has advocated the position or frame method which requires the exposure of an opaque frame or diaphragm with perforations one centimeter apart following the exposure of the mother's pelvis, the former being placed parallel to the film at the same distance above it as the inlet of the pelvis, in order to produce equal distortion of the centimeter ruling and the pelvis at the level of the inlet. For accuracy, such a method should fulfill the following requirements: (1) The pelvis of the mother must be orientated in such a manner that the plane of the inlet is approximately parallel to the film surface for the exposure; (2) External points on the mother must be available corresponding with this plane; (3) Accurate substitution of the perforated grid for the pelvis of the mother must be made for the second exposure, and (4) the x-ray tube and film must not be moved between the exposures. The meas-

urements of the anteroposterior and transverse diameters of the inlet can be obtained directly by counting the number of centimeter dots cast on the film along these diameters. The disadvantages of this method are that a special apparatus is required for placing the mother in a position approximately halfway between the sitting and supine positions in order to place the inlet of the pelvis parallel with the film surface; the x-ray beam must pass through the long diameter of the contents of the uterus, and measurements of the fetal head are made with difficulty.

A second method possessing considerable accuracy which relates to direct measurements of the phantom image of the diameters of the pelvis by stereoscopic vision has been described by Caldwell and Moloy (2). Two films of the pelvis are obtained in sequence, employing a standardized tube shift between the two exposures. For accurate measurement a "precision stereoscope" must be available. This requires exact centering of the optical apparatus in relation to both the film surfaces and the eyes, with accurate adjustments for variations in the interpupillary distance of the individual. When proper adjustments are made, the diameters of the pelvis may be

¹ The writers desire to express their appreciation for the constant help afforded them by Mr. Herbert Mermagen, chief technician, who assisted them materially in gaining technical refinements and who is responsible for taking most of the radiographs of this series.

obtained by inserting the scale (true centimeter or inch) in the virtual image behind the optical system using a black surface for a background to aid in visualizing the image in subdued light. The limitations of the method are essentially three in number, *viz.*: only persons possessing highly de-

veloped stereoscopic vision may use the method; the common stereoscopes used in roentgenological work to-day are not of a type to permit precision work, and movement of the fetus between exposures will result in incorrect measurements of the fetal head.

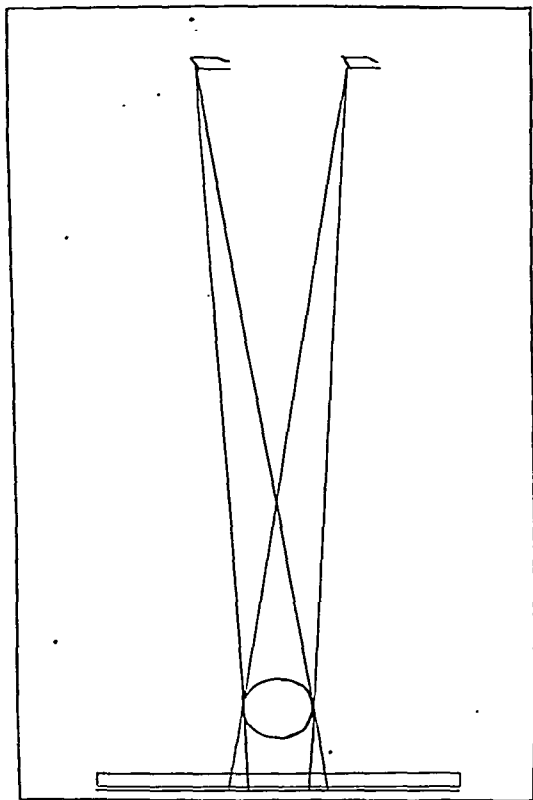


Fig. 1.

Fig. 1. Diagram showing the relations between the fetal head and the two shadows of the head cast on the film in respect to the two focal spots of the tubes. By employing rubber threads or wire on the doubly exposed film, one may reconstruct in space the manner in which the x-ray beam emanating from each focal spot passed to cast its shadow. The points at which the threads cross represent the relative and absolute position of forehead and occiput in space at the time of the x-ray examination. In practice, either the position of the forehead or occiput may be determined, first leaving a marker in space to preserve its position and, after determining the position of the second, a centimeter or inch rule inserted in space between the two positions permits the direct reading of the anteroposterior diameter of the skull. Points on the maternal pelvis may be identified in similar manner and pelvic diameter determined. In this illustration the single black line represents the film beneath the table top.

Fig. 2. Side view of phantom with elastic cords, showing the manner of the crossing of the threads and the metallic pointers preserving the points in space for the later use of the centimeter rule.

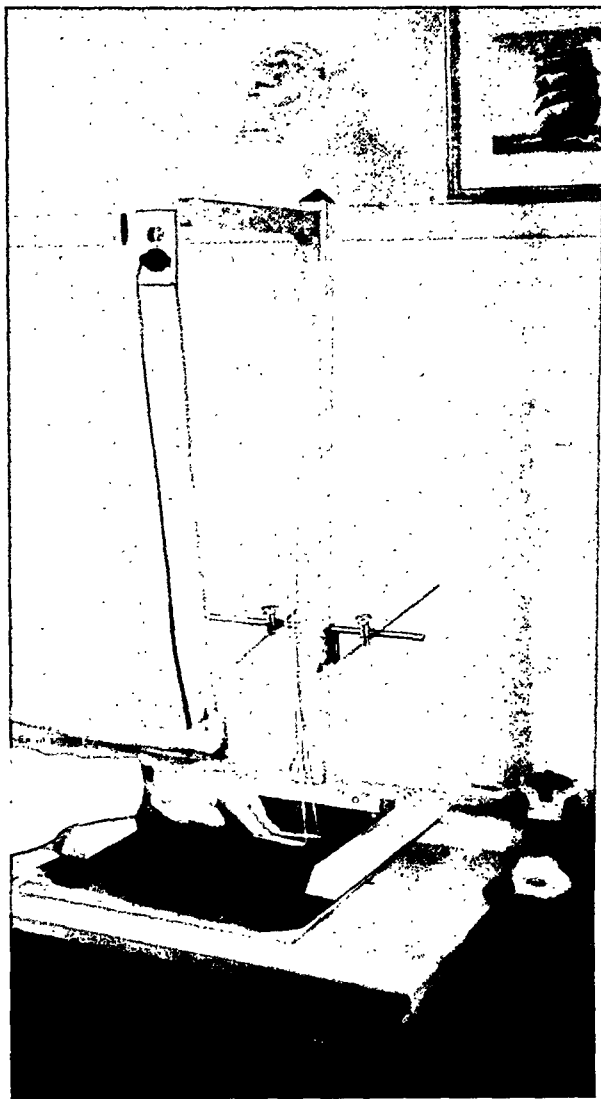


Fig. 2.

Ball and Marchbanks (1) have in recent years described an original method permitting comparison of the volume capacity of the maternal pelvis with that of the fetal head. This method employs a mechanical device for tracing the outline of the circumference of the fetal skull in the anteropos-

work. The method would appear to be open to at least one objection: movements of the fetal head between the two exposures will result in inaccuracies. Hodges has suggested a special apparatus, an obstetrical jacket, to maintain the mother in proper standing position for two exposures.

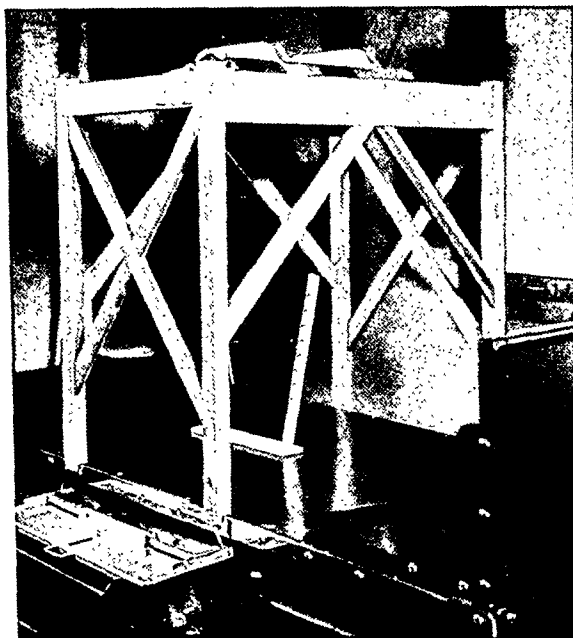


Fig. 3.

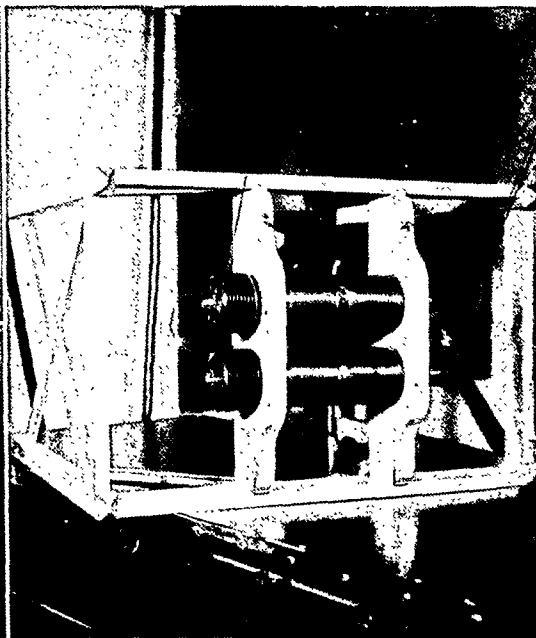


Fig. 4.

Fig. 3. Two tubes mounted at the top of the standard, fixing permanently both the distance between the tubes and the target-film distance. This equipment is centered in respect to the film by the pointer at lower end of leg of standard in the foreground (automatically), bringing the Bucky tray with its film into proper position. A test object with a series of opaque rods at varying distances from the film has been placed on the table top. A plumb bob suspended by the upper part of the carriage midway between the focal spots of the tubes serves to center the fetal head on maternal pelvis.

Fig. 4. The tube standard has been placed on its side to show the alignment and fixation of the two x-ray tubes.

terior and lateral projection and the true conjugate and bi-ischial diameters of the maternal pelvis. The instrument provides means for correcting for distortion, for conversion of circumference of the fetal head into a volume measurement, and similar conversion of diameters (maternal pelvis) into volume measurements. By making allowances for scalp thickness, molding of head, compression of scalp volume, the volume capacities may be directly compared. This method provides a novel approach to the problem, but it remains for the future to determine its dependability in routine

A fourth, and exceedingly common method of pelvic mensuration relating to triangulation, has been developed by Manges (7), Chamberlain and Newell (3), Johnson (6), Hodges (5) and others, and is commonly known as the cross-thread method of Mackenzie-Davidson. Two films of the maternal pelvis are obtained in succession, shifting the tube a known distance between exposures. In the cross-string method identical points are obtained by stereoscopic vision. The course of the x-ray beam is reconstructed by means of a phantom which employs two strings or wires to

trace out in space the path of the beams of the x-ray tube (Figs. 1 and 2). By orientating the film in exactly the same relation in respect to the phantom that existed between the film and tube during the two exposures, one may identify the exact path of the beam for any selected point, such as right lateral border of inlet. This point is located in space at the point of crossing of the two strings. By leaving a marker in space (point of rod) one may proceed to determine the location in space of the other end of the diameter under consideration (left lateral border of inlet). By measurement of the distance between these two points in space, the transverse diameter is obtained. In similar fashion, one may proceed to measure the other diameters in turn including the maximum anteroposterior diameter of the fetal head.

This method is fundamentally accurate in all cases in which identical points of the two films can be obtained by stereoscopy. The method possesses the same disadvantages as noted in the stereoscopic method: the individual must have well developed stereoscopic vision which requires a correct intracerebral integration of the two retinal images. There is also an additional disadvantage in this method in that the corresponding points of the true conjugate are difficult to identify by stereoscopy, even by individuals showing no limitation in stereoscopic vision, and, the films being obtained in succession, permits movement of the fetus to occur between exposures, resulting in inaccuracies in determinations of fetal head size.

We have modified this method with the following aims in mind: (1) to eliminate fetal movements; (2) to remove the need for stereoscopic vision; (3) to prevent inaccuracies arising from failure to exactly reduplicate the position of the films in respect to the x-ray tube, and, lastly (4), to reduce the cost of the examination. As finally developed, the equipment consists of a standard (Figs. 3 and 4) for supporting two x-ray tubes above the patient at a constant distance above the film surface with a constant interfocal distance between the

tubes. The standard is notched-out for reception of the tubes, thereby preventing the position of the tubes from shifting. This eliminates the need of any shift of the tube or tubes during the examinations and eradicates any errors which might arise as a result of incorrect shifting. From the central position of the equipment, midway between the two focal spots of the tubes, a plumb bob is suspended to center the equipment in respect to the Bucky diaphragm and the film beneath its grid.

The patient is then adjusted to position so that the pelvis overlies the film. A unique feature of this technic is the simultaneous exposure of the film by both tubes, the intensity of each beam of radiation being independently controlled by separate filament transformers. This is desirable since the amount of tissue penetrated by the two beams is different, though the target-film distance is maintained constant. The beam from the lower tube passes through less tissue because of the configuration of the lower pregnant abdomen. A bag of rice flour molded over the lower abdomen will in part compensate for this, but we have found it extremely desirable to control the amount of current passing through each tube at will. The film when exposed shows double silhouettes of both the maternal pelvis and the fetal head (Fig. 5). This may seem to be a disadvantage but, in fact, it saves the time required in making exact superimpositions of the two films, matching of opaque markers, punching out of points, or tracing of both silhouettes on a sheet of drawing paper, and at the same time it eliminates any error which arises in the execution of the technic. The corresponding points on the pelvis (Fig. 6) are marked directly on the film. They are: the points farthest from the midline, representing the ends of the maximum transverse diameter; the points of the two oblique diameters extending between points on the sacro-iliac synchondrosis and the ileopectineal eminences of the superior pubic rami, and points at the ischial tuberosities representing the ends of the interischial diameter. We have found that the

true conjugate diameter cannot be reliably obtained by this method, because it is impossible to identify accurately the sacral

resection charts, or special instrument (Thoms' method). This lateral projection (Fig. 7) also gives most valuable informa-



Fig. 5.

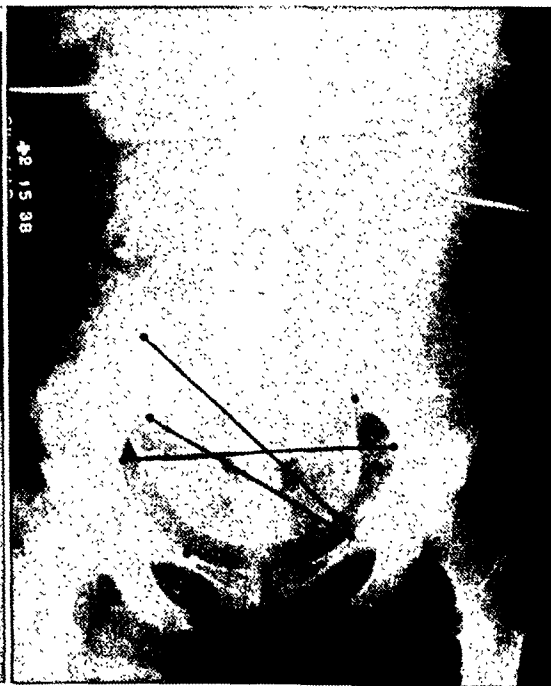


Fig. 6.

Fig. 5. A doubly exposed film showing the two shadows of a single fetal head with black dots marking similar points on the calvarium of the fetus. To determine the occipitofrontal diameter, the points showing maximum separation at forehead and occiput are selected for one of the shadows of the head, and similar points also showing maximum separation are selected for the second shadow of the head, which permit the occipitofrontal diameter of the skull to run in a plane parallel with the first. The results are not invalidated by a moderate amount of rotation of the head of the fetus but they cannot be determined in this manner in cases with marked rotation. Under the latter conditions the mother must be rolled into a partly oblique projection to render the anteroposterior diameter of the skull more nearly parallel to the film surface. The metallic rod (10 cm.) is always measured for control purposes.

Fig. 6. Maternal pelvis showing points selected for mensuration of pelvic diameters, the film being singly exposed for purpose of this illustration to avoid confusion. Note that the true conjugate is not measured by this method. If this is attempted, error is apt to occur due to the difficulty in identifying the promontory of the sacrum. The points of the right and left oblique, widest transverse and intertuberosity diameters are shown, as well as the points on the fetal head for determining the fronto-occipital diameter. The metallic markers in the upper position of the abdomen were used for test purposes.

promontory cast by either of the two tubes. This same defect is inherent in the cross-string method as carried out by Johnson. The inlet is not parallel with the film surface and corresponding points are not determined even if stereoscopy is employed. It is believed by the writers that the true conjugate is best determined by a lateral projection, employing an opaque centimeter scale at the midsagittal plane of the body, fold of buttocks, permitting direct measurement of the true conjugate diameter of the inlet without the need of graphs, cor-

rection concerning the size of the sacro-iliac notches, contour of sacrum, pelvic inclination, and data concerning the outlet. This type of lateral film is desirable, regardless of the technic used for the anteroposterior projections—whether stereoscopic, frame, cross-thread, or the volume capacity technic. We use an erect standing position for the patient with a target-film distance of 76 cm., placing the centimeter scale of brass in the upper part of the fold of the buttocks. The true conjugate is then made by using the distorted centimeter scale on the

film for measuring the distance between the anterior aspect of the first sacral segment and the posterior aspect of the pubic



Fig. 7. Lateral projection of pelvis showing true conjugate diameter of the maternal pelvis and transverse diameter of fetal head (Thoms' method).

symphysis immediately below the superior margin. Thus by use of only two films all the essential diameters of the pelvis usually determined by other technics are obtained with either fewer films, decrease in the possibilities for error, or both.

The accuracy of the proposed method in measuring a linear object such as a rod was determined in this series by placing a brass rod 10 cm. in length on top of the abdomen during the exposure, a position in which distortion is greater than at the level of the maternal pelvis or fetal head. The length of the rod was determined by the cross-thread method in a large series in this manner with the results shown in Table I. When the metallic object is directly exposed without the interposition of the heavy maternal abdomen, the measurements correspond accurately without any variation (accurate within 1 mm.). The 1 or 2 mm. variation obtained when a subject is employed appears to be due to two causes: the ends of the rods are often not sharply demarcated due to lack of contrast

resulting from x-raying the object through the thick heavy parts of the subject, or the straight rod, unless firmly anchored by adhesive, may rock slightly on the rounded contour of the abdomen.

Greater variation is to be expected in measuring fetal head size, because of the changes in shape and alterations in cephalic diameters occurring during the passage of the head through the birth canal. The roentgenologic measurements are frequently taken prior to the descent of the head before molding has occurred, while the clinical measurements are made very shortly after this descent has been completed (day of birth). Furthermore, variations must of necessity be present due to the manner in which the measurements are made. The measurements of the diameter, for example, are made roentgenologically by selecting the longest diameter between points on the outer table of the frontal and occipital bones, while the clinical measurements are made by selecting points at the skin surface, using moderate compression. All clinical measurements in this study were made by a single individual (W. T. P.), avoiding variations due to the personal equation as much as possible, but even under such circumstances the clinical measurements should exceed the measurements determined between bony points, and if molding has been extreme or a large caput is present at the level of the occipitofrontal diameter, the clinical diameter may greatly exceed the diameter determined by roentgenography.

To permit comparison, a constant allowance of 5 mm. was made for skin thickness over both frontal and occipital regions, this measurement being added to each of those made roentgenologically. A comparison of the two sets of measurements is shown in Table II. It was felt that in view of possible molding effects a reasonably close approximation might have been assumed to be present if the variation did not exceed 5 mm. That the effects of molding may exceed this amount is to be admitted, but for the purpose of this analysis it was thought advisable to search for other fac-

tors as a cause of variation. Three-fifths of the cases were found to fall within the limit of 5 mm. variation, leaving 24 cases deserving further analysis.

A review of our cases (Table III) shows that one-half of the 24 cases showed such a marked degree of rotation that foreshortening of the x-ray shadow should be

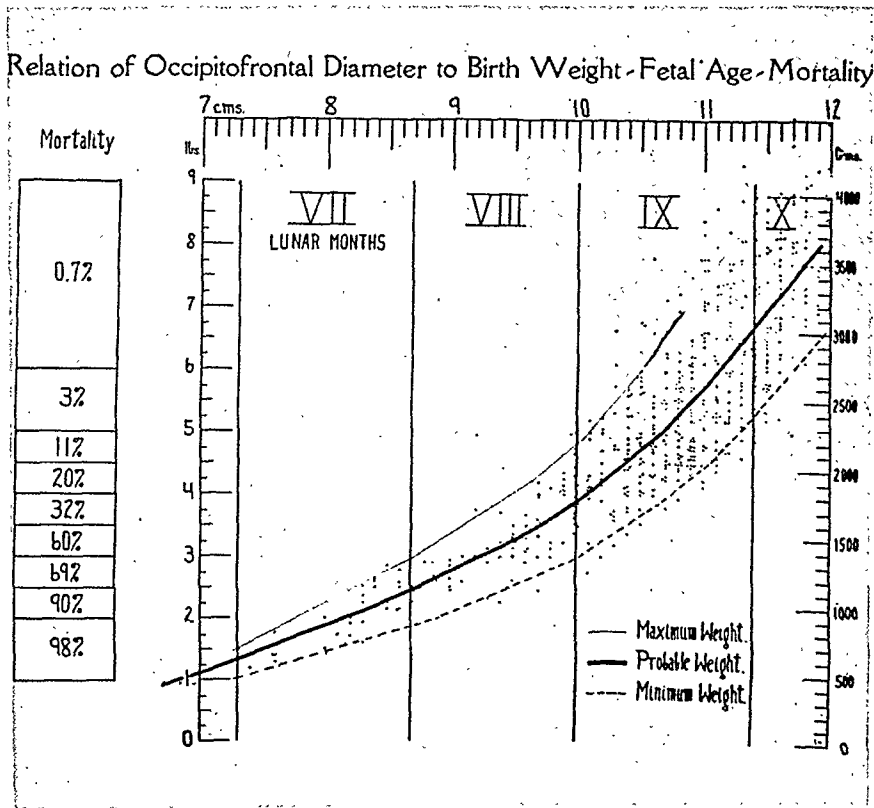


Fig. 8. Chart by S. H. Clifford. (West Virginia Med. Jour., 31, 3, 1935.)

The following factors may be considered as potential sources for these discrepancies: marked rotation of the fetal head within the pelvis resulting in foreshortening (abnormally short occipitofrontal diameter); considerable elapse of time between the roentgen-ray examination and the birth of the baby; marked deformity of the head as a result of application of forceps or the deformation of the head, or a very large caput, or a combination of the preceding factors.

expected. Three cases showed a long time interval between examinations (from 15 to 21 days), and in these cases the continued growth of the head following the roentgenological examination was probably an important factor.

There were nine cases remaining which were more difficult of analysis, and in which it was questionable whether the x-ray or clinical measurement of the head more nearly approached the true size of the occipitofrontal diameter of the cranium. Clif-

TABLE I.—VARIATIONS IN MEASUREMENT OF 10 CM. CONTROL ROD

No Variation	No. Determinations within 1 mm.	No. Determinations within 2 mm.	No. in Excess of 2 mm.	Total
23	30	11	0	64

ford's correlation chart (Fig. 8) was used to determine which of the two sets of measurements corresponded more closely to the predicted values of the occipitofrontal diameter, this prediction being based on body weight, a value entirely independent of such factors as molding, distortion of head, and the personal equation. Sub-
jected to such an analysis, five out of the nine remaining cases showed close correlation between roentgenologic and predicted values based on weight, and a poor correlation between the clinical measurement and the predicted measurement. This suggested that in all probability the clinical measurement could not be determined with accuracy due to head deformation or that marked change in head shape had occurred during the passage of the head through the birth canal.

There remain only four cases which cannot be explained on the basis of head rotation, extensive head deformation, or time interval elapsing between examinations. In two of these four cases, the opaque metal rod was measured without error, the third showing one millimeter variation, and the last two millimeters variation. The reason why we could measure the length of the rod which was approximately the same length as the occipitofrontal diameter of the fetal skull without any appreciable error, but were unable to obtain similar accuracy with the diameter of the skull, remains obscure at this time but will form an objective for our future work.

CONCLUSIONS

1. A triangulation method employing the cross-thread principle has been described which permits simultaneous energizing of two x-ray tubes casting a double image of the object to be measured on a single film.
2. The length of a linear object, such as a 10 cm. rod, is commonly measured with variation of one millimeter or less in approximately five-sixths of the cases.
3. A solid object such as the fetal head offers more difficulty due principally to the effects of rotation of the head. This error, which occurred in only one-fifth of our series, can perhaps be largely eliminated in the future by securing a doubly exposed film, rotating the patient in such a manner that the maximum diameter of the fetal skull is obtained.
4. Pelvic measurements may be secured by the same method (anteroposterior film) except for the true conjugate. For this measurement a lateral film should be obtained which may be easily measured by the Thoms' method.
5. This modification of the triangulation method possesses three advantages, namely, the method employing simultaneous use of two x-ray tubes prevents movements of fetal parts which frequently occurs when films in succession are obtained; the fixed character of the apparatus prevents errors of a technical character due to variation in tube-film distances and tube

TABLE II.—VARIATIONS IN MEASUREMENTS OF THE OCCIPITOFRONTAL DIAMETER OF THE FETAL HEAD MADE BY ROENTGENOLOGIC MEANS (PRIOR TO BIRTH), WITH COMPARISON OF THE SAME DIAMETER DETERMINED CLINICALLY SHORTLY AFTER BIRTH

Total, 60 cases						
No Variation	1 mm.	2 mm.	3 mm.	4 mm.	5 mm.	Over 5 mm.
5	8	4	4	10	5	24

TABLE III.—VARIATIONS EXCEEDING 5 MM. IN THE OCCIPITOFRONTAL DIAMETER OF THE FETAL SKULL (24 CASES) PROBABLY DUE TO—

Rotation of Head	Time Interval between Examinations	Deformation of Head	Combination of Preceding	Unexplained
12	3	4	1	4

shifts, or failure to superimpose films accurately for use in measuring device, and the cost of the examination is reduced by substituting a single doubly exposed film for a pair of stereoscopic films.

BIBLIOGRAPHY

(1) BALL, ROBERT P., and MARCHBANKS, S. S.: Roentgen Pelvimetry and Fetal Cephalometry: A New Technic. *RADIOLOGY*, 24, 77-84, January, 1935.

(2) CALDWELL, W. E., and MOLOY, H. C.: Anatomical Variations in the Female Pelvis and Their Effect in Labor, with a Suggested Classification. *Am. Jour. Obst. and Gynec.*, 26, 479-505, October, 1933.

(3) CHAMBERLAIN, W. EDWARD, and NEWELL, R. R.:

Pelvimetry by Means of the Roentgen Ray. *Am. Jour. Roentgenol.*, 8, 272-276, 1921.

(4) CLIFFORD, S. H.: The Stereoroentgenometric Method of Fetometry and Pelvimetry with its Obstetrical Application. *West Virginia Med. Jour.*, 31, 401-414, September, 1935.

(5) HODGES, P. C., and LEDOUX, A. C.: Roentgen-ray Pelvimetry—A Simplified Stereoroentgenographic Method. *Am. Jour. Roentgenol. and Rad. Ther.*, 27, 83-96, January, 1932.

(6) JOHNSON, C. R.: Stereoroentgenometry: Method for Mensuration by Means of Roentgen Ray. *Am. Jour. Surg.*, 8, 151-163, January, 1930.

(7) MANGES, W. F.: Roentgenographic Pelvimetry. *Am. Jour. Obst.*, 65, 622, 1912.

(8) THOMS, HERBERT: The Obstetric Pelvis. Williams and Wilkins Co., Baltimore, 1935.

(9) WALTON, H. J.: Intra-uterine Roentgen Cephalometry and Pelvimetry. *Am. Jour. Roentgenol. and Rad. Ther.*, 25, 758-760, June, 1931.

THE LANGUAGE OF ENGINEERS AND RADIOLOGISTS¹

NEW X-RAY TERMS PROPOSED: RHEGMA, RHOTHION, KLUDON, PLEM, AITH

By R. R. NEWELL, M.D., Stanford University School of Medicine, San Francisco, California

RADIOLOGY and illumination concern parts of the electromagnetic spectrum. I think they are parallel fields, and I think their terms and definitions of production of light. We observe that his international unit (the candle) refers to a source. The physician is interested in the patient. We observe that

LIGHT		X-RAY	
UNIT	CONCEPT	UNIT	
A ERG	RADIATION	ERG	
B WATT	RADIANT FLUX	WATT	
C LUMEN	LUMINOUS FLUX	ROENTGEN FLUX	KLUDON
D CANDLE	INTENSITY OF SOURCE	PLEM	
E CANDLE PER CM ² APPARENT AREA	BRIGHTNESS OF SOURCE	PLEM PER CM ² APPARENT AREA (AITH)	
F PHOT (929 FOOT CANDLES)	ILLUMINATION (LUMINOUS FLUX DENSITY)	IRRADIATION (ROENTGEN FLUX DENSITY)	RHOTHION (KLUDON PER CM ²) (ROENTGEN PER SEC)
G PHOT-SEC.	(TIME INTEGRAL OF ILLUMINATION)	EXPOSURE (TIME INTEGRAL OF IRRADIATION) ("QUANTITY OF X-RAY" BY INTERNATIONAL DEFINITION)	RHOTHION-SEC. (ROENTGEN WITHOUT BACKSCATTER)
H LUMEN-HOUR	QUANTITY OF LIGHT	QUANTITY OF X-RAY (STRICTLY) (TIME INTEGRAL OF ROENTGEN FLUX) (AREA INTEGRAL OF ROENTGENS)	KLUDON-SEC. (SQUARE CENTIMETER- ROENTGEN)
I LUMEN PER WATT	LUMINOSITY FACTOR (OF A GIVEN WAVELENGTH)	COEFFICIENT OF ABSORPTION (τ PLUS σ_a)	PER CM IN AIR
J		BIOLOGIC FACTOR	NO STANDARD OBJECT
K LUMEN PER WATT	LUMINOUS EFFICIENCY (OF RADIATION)	ROENTGEN EFFICIENCY (OF A BEAM)	KLUDON PER WATT
L LUMEN PER WATT INPUT	EFFICIENCY OF A LAMP	EFFICIENCY OF AN X-RAY TUBE (FOR MEDICAL PURPOSES)	KLUDON PER WATT INPUT
M		TISSUE DOSE (TIME INTEGRAL OF IONIZATION PER UNIT MASS)	RHEGMA

Table I.

tions ought to be parallel, but find they are not.
The engineer is interested in the eco-

his international unit (the roentgen) refers to an effect. Standardization in the two fields has proceeded from opposite ends.

¹ Read before the Fifth International Congress of Radiology, in Chicago, Sept. 13-17, 1937.

Another point of difference in interest is time. Light is used for seeing. Except

for very short exposures, we are not conscious of any accumulation. But for radiology the increase of effect with lengthening exposure is fundamental.

In Table I, I have listed analogous concepts and units for the two fields. Where no name exists for the x-ray analogue, I have invented one.

NOTES ON THE TABLE

A The most fundamental quantitative aspect of any radiation is the energy it contains.

B $1 \text{ watt} = 1 \text{ joule per sec.} = 10^7 \text{ ergs per sec.} = 0.239 \text{ small calories per sec.}$

C Quoting the definitions given in the Report on Definitions of Electrical Terms, sponsored by the American Institute of Electrical Engineers,

"Light is radiant energy evaluated according to its capacity to produce visual sensation."

"Luminous flux is the time rate of flow of light." We wish now to name an analogous concept:

Roentgen flux is the time rate of flow of radiant energy evaluated according to its capacity to produce ionization (per unit length of path in air).

One *kludon* is the roentgen flux per unit solid angle emitted by a unit source.

D The *intensity* of a source is its solid-angular flux density in a given direction. From the luminous unit (1 candle) this is 1 lumen per steradian. From a source of unit roentgen intensity (1 *plem*, shall we call it?), it is 1 kludon per steradian.

This defines the word "intensity" precisely, but we often use it loosely. We may say "an intense light" when we mean an intense source, but also when we mean a bright (concentrated) source or even when what we mean is high illumination. When a physician says "intense x-ray" he probably means high total roentgens to a limited area. He might mean many roentgens per second. When he wishes to express the idea of an in-

tense source he will most likely call it a "fast x-ray tube."

In an incandescent electric lamp one is interested in total flux, *i.e.*, lumens; but in a searchlight one is interested in intensity, *i.e.*, candle power. So, for therapy one is interested in plems (intensity) rather than in kludons (total roentgen flux). So if a manufacturer advertises the power of his therapy apparatus in quantitative terms, it is plems, not kludons, he will write about. (This distinction would be of more importance if one could reflect x-rays from a parabolic mirror and so make an x-ray searchlight.)

E $\text{Brightness} = \text{intensity} \div \text{apparent area (for both light and x-ray).}$

One must note, however, one large practical difference: Take a perfectly diffusing surface of finite area. It looks just as bright if viewed obliquely, but its apparent area is less. So it appears less intense. But take a flat x-ray source. It appears just about as intense measured off at even quite a high angle. Its apparent area being less, its brightness must be greater.

For light: $\text{Intensity} \sim \cos. \vartheta$

For x-ray: $\text{Brightness} \sim \sec. \vartheta$

We remark in passing that the diffusion of light and the scattering of x-rays are not the same.

F A corollary of the cosine law for brightness is the falling off of illumination at oblique angles. But in x-ray we are interested in a volume effect, namely, the ionization produced by the radiation as it passes through (and is somewhat absorbed by) the superficial layers (and in the depth) of the body irradiated. This means that the obliquity of the surface is of almost no importance and we will always take the roentgen flux density through an area perpendicular to the beam.

Note that *brightness* refers to flux-density starting out; *illumination* and *irradiation* to flux density arriving.

ject, but in free air with object far removed).

OF WHAT USE?

To present appearances all this is mostly useful as an exercise in thinking. However, it might make easier the saying of some things.

The economics of water-cooling a therapy tube might be expressed by saying that such a one runs at 3,000 plems (through 0.5 mm. copper), whereas most "air-cooled" deep therapy tubes run at about 500 plems.

Primary irradiation might very nicely be given in ronthia. Coutard has felt it important to treat with not more than about a twentieth ronthion but is interested to investigate American high intensity apparatus at about one ronthion. Total irradiation as it concerns danger to the blood-forming organs (as an indirect measure of total energy absorbed by a patient or employee) might be recorded in kludon-seconds, a less awkward term perhaps than square centimeter roentgens. One might, in treating a patient suffering from Hodgkin's disease, with small doses over large areas give a total of 100,000 kludon-seconds and repeat it twice a week. One would have to guard against carrying this too far, for the usually accepted safe limit, one erythema dose in ten years if integrated for half the body surface is only eight million kludon-seconds. And, of course, the body will not bear this so well if given in months instead of years. I have seen dangerous leukopenia follow six million kludon-seconds administered over ten weeks' interval for cancer metastatic in the bones.

For therapy tubes the size of the focal spot is of little moment, but for roent-

genography a high intensity is valuable only if the focal spot is not made too large. A tube might claim a brightness of 20,000 aith (1 mm. Al filter) at 70 kv. (peak) for exposure times of $\frac{1}{20}$ sec. A line focus tube would double this. A Rotalix tube could claim 300,000 aith under the same circumstances. These are only guesses: we have not made measurements. Also this last paragraph ignores the fact that while our roentgen units concern ionization in air, roentgenography is done by effect on silver bromide.

I think that the use of *roentgens* to record tissue dose as well as incident radiation is productive of ambiguity in thinking and writing. I believe that the adoption of a uniquely named unit for tissue dose, the *rhegma*, is practical and important for clinical records.²

I wish to thank Dr. M. G. Lloyd, of the National Bureau of Standards, for his encouragement and advice in the development and presentation of these ideas. I also owe thanks to Dr. Lauriston Taylor, Mr. E. C. Crittenden, both also of the National Bureau of Standards, Dr. E. W. Martin, Professor of Greek at Stanford University, and Dr. James Allen, Professor of Greek at the University of California.

² At the reading of the paper, Dr. E. Pugno-Vanoni remarked that he had long been interested in the parallel concepts of radiology and illumination and referred to two publications: *L'Elettrotecnica*, 15, 814-817, 1928, and F. Perussia and E. Pugno-Vanoni, *Trattato di Rontgen e di Curie-terapie*, pp. 165-167, Milan, 1934. Although he gave symbols, equations, and dimensions for some of the radiological quantities, he did not suggest names for units.

REFERENCES

- (1) TAYLOR, L. S.: *Am. Jour. Roentgenol. and Rad. Ther.*, 34, 84-88, July, 1935.
- (2) Idem: *Nat. Bur. Standards Jour. Research*, 17, 557-576 (Research Paper No. 927), October, 1936.

AN X-RAY INQUIRY INTO THE GENESIS OF THE CURRENT OF VENOUS BLOOD AND LYMPH¹

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AS a means of explaining the current of venous blood and lymph, x-ray investigation is superior to all other methods, the latter being, as a rule, vitiated by concomitant circumstances of a non-physiologic nature, which always leave doubt as to whether or not the results obtained are in complete agreement with conditions naturally prevailing in the living organism.

X-ray investigations, together with the science of oscillations, so well developed at present, enable us to watch *in vivo et in situ* certain hydrodynamic phenomena of a similar kind, such as those observed by Bjerknes in the surroundings of pulsating (respiring) and oscillating globes in water. Analogous phenomena were found in other objects by Dworak, Guyot, Guthrie, Schellbach, W. van Schaik, and others. Throbbing arteries likewise produce periodical changes of hydrodynamic pressure in their environment, and these changes are the cause of a steadily progressive movement of the fluid contained in neighboring veins and lymphatic vessels. That fluid flows in the direction of negative pressure in the thorax, *i.e.*, of resistance considerably smaller than that existing in the opposite direction on the circumference. The resemblance of the arteries to Bjerknes pulsating globes has been pointed out by the present writer.²

Notwithstanding that, at first blush, the phenomena observable in the environments of arteries and of Bjerknes globes differ in outward appearance, they constitute, nevertheless, one and the same physical phenomenon, and their fundamental identity is revealed by the closer scrutiny of facts.

In this paper we are chiefly concerned with the x-ray investigation of this phe-

nomenon. For the purposes of our inquiry, however, we shall also have to glance at what happens in any part of the body, say in a limb, while the arteries pulsate.

During that pulsation all the exceedingly sensitive veins and lymphatic vessels throughout the limb (by no means only the so-called "accompanying veins") receive on all sides a series of sudden strokes, each of which is scarcely finished before it is followed by the next stroke. Hence arises a constant pressure upon the tender veins and lymphatic vessels, just as the pressure of some gas upon the walls of a vessel is the cumulative effect of the gaseous particles incessantly striking against the walls of the vessel. At every beat of the pulse the limb is suddenly enlarged by the new quantity of blood entering it, as is proved by plethysmography. But as the tissues of the elastic center of the limb are closely joined together, the kinetic energy released by every beat of the pulse is continually transferred to the easily shifted liquid contents of the veins and lymphatic vessels, and owing to the cumulative effect of these moves, which are repeated in rapid succession, that liquid is constantly propelled in the direction of the least resistance, *i.e.*, toward the heart. An additional factor contributing to bring about this result is the circumferential elasticity of all the tissues, including the skin of the limb, which alternately changes in bulk in accordance with the rhythmical rise and fall of pressure caused by the intermittent inflow of arterial blood.

These phenomena, which are also of importance to pathology, can be observed *in vivo et in situ* on the x-ray screen during irradiation, when a contrasting fluid has been introduced into certain canals in the organism. I shall give a few examples of x-ray investigation illustrating the action

¹ Presented before the Fifth International Congress of Radiology, in Chicago, Sept. 13-17, 1937.

² *Strahlentherapie*, 56, 285-297, 1936.

of transmitted pulsation as described in the foregoing paragraph.

The essential facts of this action will be

grasped most easily if we start with a discussion of the simplest instances, such as are accessible to every roentgenologist,

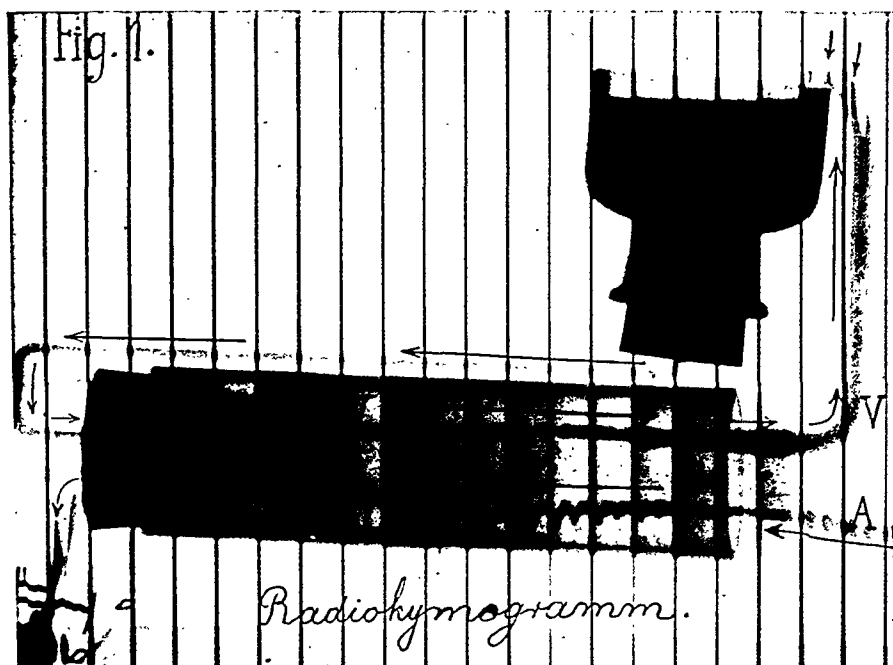


Fig. 1. Model showing transmission of pulsation: the beat of the pulse in the elastic tube A, the artery causes the cross-section of the second tube, V, the vein, immersed in liquid, to be contracted, and, consequently, the contents of the vein to be pressed out in the direction of the least resistance.

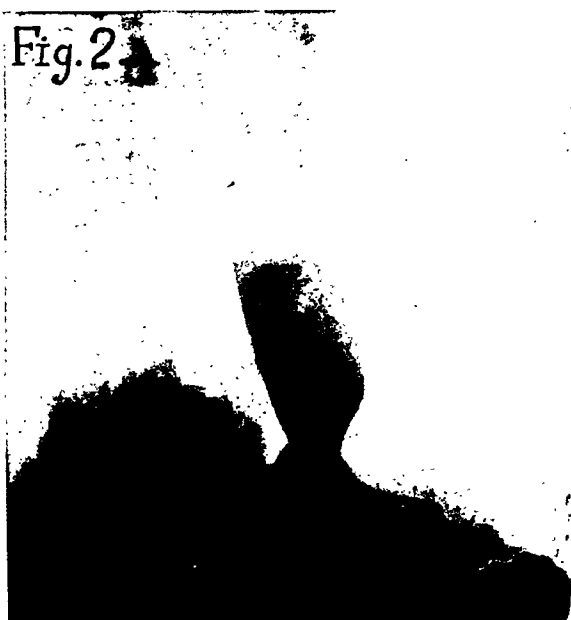


Fig. 2. Esophagus deprived of peristalsis, seen during systole of heart. Carcinoma cordiae.

Fig. 3. The same esophagus filmed during diastole of heart. One of a series of films taken at short intervals, while the breath was held, showing the motion of the contrasting substance, a pure liquid, under the influence of the transmitted movements of the esophagus toward the head.

and then gradually extend the rules with which we shall have become acquainted to cases in which the mechanism of the afore-

its environment, can observe a rhythmical shifting of the contrasting fluid, synchronous with the beating of the pulse, in the

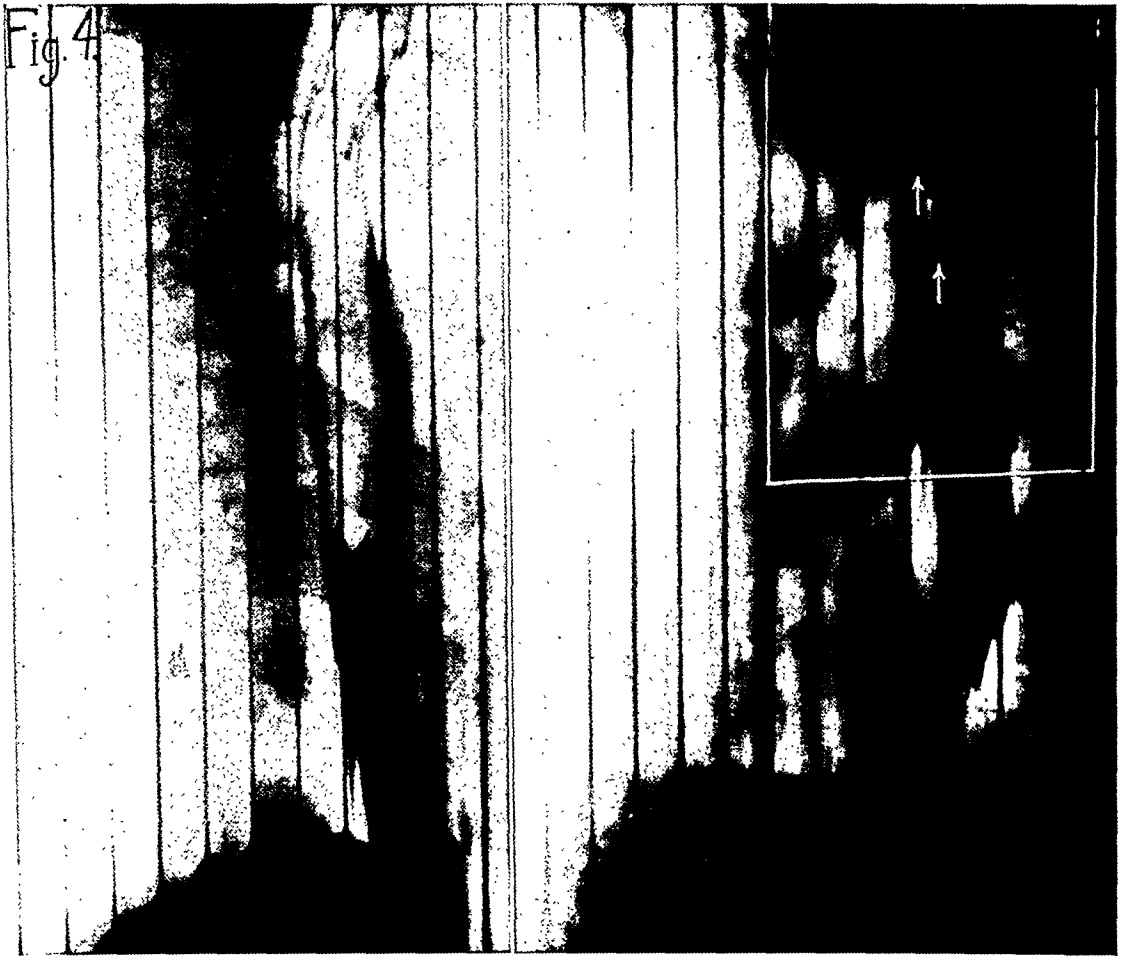


Fig. 4. Another esophagus, in upright position. Influence of cardiac pulsation.

Fig. 5. The same esophagus in the prone position. The transmitted pulsations produce motion in the direction of the least resistance, *i.e.*, toward the head.

said action is neither conspicuous nor even immediately perceptible.

We often see on an x-ray screen transmitted motions of certain elements in a picture of the lungs, the esophagus filled with a contrasting fluid, the stomach, the duodenum, and other segments of the entrails. Under favorable conditions, as in esophagi deprived of the peristaltic movements or in cases of cardiac carcinoma, any roentgenologist who takes the pains to notice it and who eliminates all other factors displacing the fluid in the esophagus, leaving only the pulsatory motions of

direction of the least resistance, *i.e.*, toward the mouth. A stream (current) of the contrasting fluid moving rhythmically backward, the motion being synchronous with the pulsatory oscillations of the circumference of the region surrounding the esophagus, can be seen when watching such an esophagus while the patient is prone and holding his breath. Nothing but the pulsation of the region surrounding the esophagus is transmitted to the contrasting liquid, causing it to flow. Even when the patient is in the standing position it can be seen that the contrasting fluid does not

by any means remain motionless above the constricted cardia of the stomach but keeps bobbing up rhythmically, this being

nomena. The current of liquid in the esophagus, as described in the foregoing paragraph, proves that rhythmical oscillations



Fig. 6. Control of the motion of the lipiodol filling of the bronchi while the breath is held. The lipiodol is first seen in the foremost parts of the bronchi, before it begins, with the pulsation, to undergo a rhythmical translocation into the bronchioles, as is shown by the next roentgenogram.

Fig. 7. This roentgenogram was taken 20 seconds later than the preceding one. It shows that, while the breath was held, the contrasting mass was intermittently pushed into the bronchioles. The breath was held for 20 seconds. The same position was held continuously.

merely the pulsatory narrowing and widening of the shadow of the esophagus, without the peristaltic movements. Similar phenomena are sometimes observed in perfectly healthy esophagi. It is known that in a sound esophagus too, the contrasting fluid usually remains in the lower region of the esophagus for a certain space of time, longer or shorter as the case may be; and it is during this time that the contrasting fluid becomes noticeable. This mechanism of the displacement of the fluid can also be studied on x-ray films of the esophagus, taken at various intervals of time and in different phases of the action of the heart or aorta.

The phenomena connected with the genesis of the current of liquid contents, whether in the esophagus or in veins, are easily studied only in isolation, but this study enables us to construct a picture of the common cause underlying these phe-

of the dimensions of the circumference *in vivo et in situ*, in the shape of pulsations in the whole environment of any tender and flexible tube in the living organism, are capable of producing in it a continuous current of liquid flowing in one and the same direction.

An excellent proof of this assertion is afforded by the following instance. As is well known, the smaller bronchioles in the lungs have no annular cartilages, and there are other reasons for which these sensitive, thin-walled tubes may be compared to veins with an accuracy sufficient for the purposes of the present argument. The environment of these bronchioles consists of connective tissue, sanguiferous and lymphatic vessels, and nerves.

Since lipiodol in the bronchioles may flow in the direction of the negative pressure of the pleural cavity, conditions are also in this respect comparable to those

in veins. When the bronchi were filled with lipiodol and the breath held, I likewise observed that the contrasting liquid under-

co-ordination of the motions in question directly in blood vessels made visible by means of contrasting fluids, because of the



Fig. 8. Kymogram of aorta and esophagus filled with contrasting substance in a horizontal position, the breath being held. Passive translocation of contrasting liquid toward the head owing to transmitted pulsation movements of the esophagus. Film reveals very large and sharp indentations. The movements of the contrasting liquid are of a mixed character, and the part borne in them by the *current* of the liquid is indicated.

Fig. 9. Kymogram of the vena cava superior. Light and dark stripes can be seen on it, distinctly visible in the original, being the expression of the alternating changes in the volume of the environment and of the vein. No cardiac suction is needed to produce these changes, as is proved by the following experiment: From the *cut* vena femoralis of the hyperemized leg of an animal, *venous blood flows out*, with *distinctly noticeable pulsation*, merely because of the oscillations, enhanced by the arterial hyperemia, in the volume of the whole leg.

went, simultaneously with every pulse of the environment, rhythmical shiftings toward the circumference, *i.e.*, steadily onward in the direction of the least resistance (Donders' pressure). This stream of the contrasting liquid due to the influence of transmitted pulsation is observable both in the distant parts at the periphery of the lungs (the upper dexter lobe) and in the vicinity of the heart.

Although it is difficult to investigate the

rapidity and small amplitude of these motions, nevertheless, valuable services may be rendered here by short-time x-ray photographs or snapshots, x-ray cinematography, radiokymography, and densography. By these aids we are enabled to examine not only the action of the rapid oscillations of the volume in the shape of ordinary pulsation but also the action upon the current of venous blood and lymph of slow changes in the volume of the sur-

rounding tissues, changes due to various psychic states, chemical substances, irritations of certain tiny branches of the

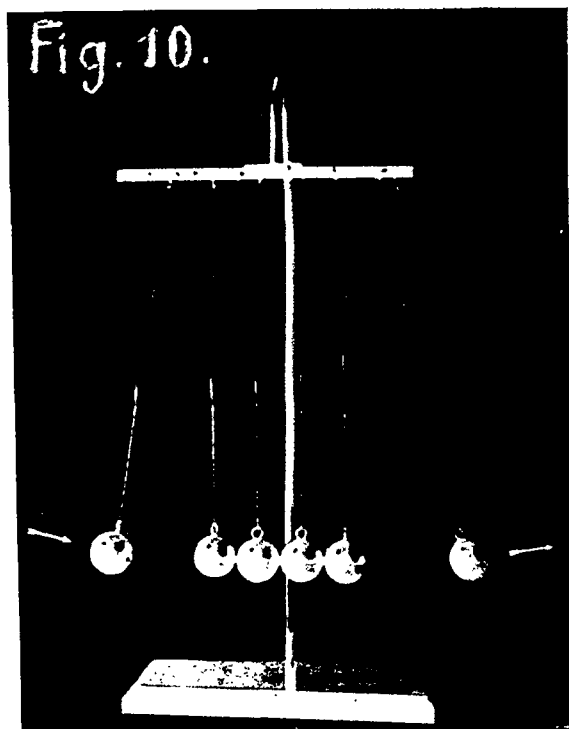


Fig. 10. Transmission of impetus: at the moment when the first ball, 1, strikes against a row of balls, its entire kinetic energy is imparted to the last ball, while the other balls do not move. The first ball, 1, may be taken to represent, for the sake of our argument, the pulsating arterial blood, the last ball, 6, the venous blood, and the intervening balls, the layers of tissue between those liquids.

nervous system, varying states of the pneumothorax, etc. Lastly, I have made use in my experiments, of tissue infiltration over an area varying *ad libitum* by means of inter-tissue injections of contrasting compounds. The technic of such injections of contrasting chemicals was substantially the same as that of C. L. Schleich's method of local anesthesia. Circumferential oscillations, *e.g.*, of a limb, can be modified in various ways, especially by a greater or lesser amount of pressure upon the arteries carrying the blood to the limb.

On the basis of my x-ray investigations I have arrived at the following conclusions:

1. The simplest conditions causing the

venous blood and lymph to pass from the periphery to the heart exist in the small bone ducts with blood vessels running through them. As the arteria nutricia and the vein, both immersed in lymph, run along the inside of the stiff-walled bone ducts, the sudden influx of arterial blood at every beat of the pulse distends the lymphatic liquid surrounding the artery. At the same time the vein also experiences over the entire surface of its tender wall, a stroke or sudden compression through the medium of the lymph, in consequence whereof the venous blood and lymph are propelled, at every beat of the pulse, exclusively in the direction of the least resistance, *i.e.*, toward the heart; and this again entails a fresh influx of venous blood and lymph from the circumference. Hence it follows that, in the last instance, the force moving the venous blood and lymph in the vascular ducts of all the bones is the same pressure of liquid as that operating in accordance with Archimedes' law. The system of bones is one of the two principal component parts of the body; hence the above-mentioned force is the proper cause of the current of venous blood and lymph in a considerable part of the human organism.

2. Analogous conditions prevail in other parts of the body. With every beat of the pulse the suddenly growing pressure produces greater rigidity (hardness) in the whole region surrounding all the venous and lymphatic vessels, just as in the bone ducts, for these vessels are enclosed not only by tougher and tenser arteries but also by tenser tissues, which are in consequence of their structure less sensitive than the easily shifted liquid contents of the venous and lymphatic vessels.

At every beat of the pulse the sudden shock issuing from the whole surface of the artery is transmitted to the adjacent layers of tissue. This motion is transmitted from layer to layer without producing any movement in them until the last layer is reached. This one does not offer resistance and can move forward without hindrance, being the liquid con-

tents of the venous and lymphatic vessels. This liquid layer, in the shape of venous blood and lymph, is put in *visible* motion in a similar way as the last ball in the well-known physical experiment of a series of elastic balls. If we set the first ball going so that it strikes the next then *this motion is invisibly transmitted from ball to ball*, and only the last of the series, not encountering any resistance, moves forward in a way distinctly perceptible to the

eye. Thus the last ball (the venous blood) acquires the whole energy of the first striking ball (the arterial blood) while the intermediate balls (the tissues dividing the venous blood from the arterial blood) may remain motionless. The final result, in the shape of a flowing current, is great beyond expectation; first, because of the suddenness and rapidity of the strokes, and then, above all, owing to the cumulative effect of the frequently repeated single actions.

A NOTE ON THE USE OF CLINICAL DOSAGE METERS USING A THIMBLE IONIZATION CHAMBER

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IONIZATION instruments used to measure the amount of radiation delivered to a patient may be classified into two groups: (1) those which measure the radiation transmitted through the filter, thus acting as a check on the filter as well as the output of the generator; (2) those whose chambers are placed on the skin of the patient and measure both the incident and the scattered radiation. The first type has an arbitrary scale to measure intensity and must be calibrated to read in roentgens for each individual generator. The second type may be read in roentgens directly.

Obviously the use of either type offers the roentgenologist a feeling of certainty in his ability to control and measure the number of roentgens delivered to his patient. On the other hand, there are certain dis-

advantages associated with both types and it is the purpose of this paper to call attention to some of these disadvantages and the possible inadvisability of their use without definite precautions.

One of the principal disadvantages of type one was illustrated definitely at a recent calibration of a 400,000-volt x-ray generator. This generator was equipped with a small thimble ionization chamber located in the center of the x-ray beam several inches below the filters and connected to the measuring instrument located on the control stand. This instrument served to integrate the amount of radiation and yet by its location was used as a constancy meter. The thimble chamber of the calibrating r meter was placed approximately 50 cm. below the integrating cham-

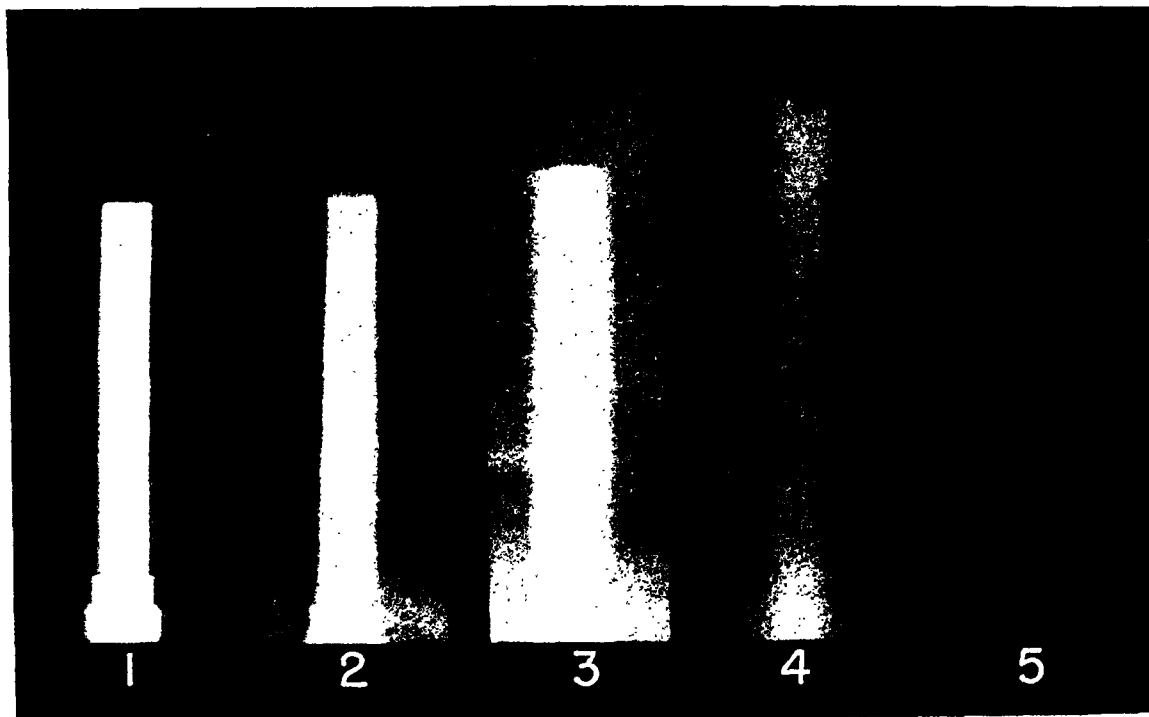


Fig. 1. Shadow cast by a chamber tube in a phantom: 1, at the surface; 2, at 4 cm. depth; 3, at 8 cm. depth; 4, at 12 cm. depth, and 5, at 19 cm. depth.

ber which in turn was 40 cm. from the target. Since the portion of the metallic tubing connecting the ionization chamber with the measuring instrument (so-called chamber tube) was in the beam, it was reasonable to suppose that this metal might cast a shadow. To confirm this belief and determine the amount of absorption in the chamber tube, ionization measurements were made with the integrating chamber in place and again with the chamber removed. There was a difference of 8 per cent in the measurements, or in other words, the integrating chamber tube was casting a shadow detectable at the distance mentioned. In order to confirm this point, additional measurements were made with a thimble ionization chamber smaller in diameter than that of the integrating chamber tube, at distances of 5 and 15 cm. below it. The small chamber was used so as to be completely within the shadow of the integrating chamber. At the distance of 5 cm. there was a 12 per cent absorption and at 15 cm. there was an absorption of 10 per cent by the chamber tube. From these results we conclude that even for hard radiation generated by 400,000 volts the chamber tube casts an appreciable shadow detectable at distances at least as far as 50 cm. below.

In the second group of dosage-measuring instruments in which the ionization chamber and tube are placed directly on the skin of the patient with the chamber itself located in the center of the beam, not only the intensity of the incident radiation is determined but also the maximum amount of back-scattering. However, since the chamber tube is frequently of metal, it follows that here, too, there may be a shadow cast. To determine the existence of this shadow and the depth at which it is determinable, a thimble chamber and chamber tube were placed on the surface of a wood phantom with photographic films in the phantom at various depths, 0, 4, 8, 12, and 19 cm. below the surface. Figure 1 shows the result of a short exposure of this set-up to 200,000-volt x-rays filtered by 0.5 mm. of copper and very definitely indi-

cates that the chamber tube casts an appreciable shadow even to a depth of 19 cm. below the surface of the phantom. The chamber tube may be constructed of organic material instead of metal which would tend to reduce considerably the shadow cast.

Obviously, if the chamber were not centered in the treatment area, but located near the sides or corners of the radiation area, this shadow effect would be negligible. However, it is well known that the intensity of the radiation decreases rapidly at the periphery of the treatment area, the decrease frequently being as much as 20 per cent less than in the center. The placing of the chamber at the edge of the beam might result, therefore, in the center area receiving 20 per cent more radiation than was indicated by the dosage meter.

Another difficulty encountered in placing the thimble chamber on the skin, is the degree of submergence. The ideal arrangement would be to have the chamber one-half submerged, but this is practically impossible at all times and the difference in the reading obtained with the ionization chamber just lying on the skin, as would be the case over a bony structure, and when it is completely submerged, as it may be when treating an abdomen or breast, is approximately 12 per cent. This amount may represent the difference between two areas on the same patient or on different patients, although the dosage meter may show the same reading in both cases.

CONCLUSIONS

This note calls attention to:

1. The existence of a shadow cast when a thimble ionization chamber with a metal chamber tube is placed in the radiation beam either between the filter and the skin or directly on the skin.
2. The variations in intensity when the thimble ionization chamber is placed in the center or at the periphery of the radiation area.
3. The variation in intensity with the degree of submergence of the chamber on the skin surface.

THE ROENTGEN TREATMENT OF LEUKEMIA, WITH REPORT OF A PREGNANCY IN A CASE OF LYMPHATIC LEUKEMIA

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LEUKEMIA was first described in 1845, by Virchow and Hughes Bennett, who independently discovered the disease but did not describe the difference in the cell types. In 1891, Ehrlich described the different cell types which distinguish the myeloid from the leukemoid form of the disease.

Since its discovery, cases of leukemia have been met with in increasing numbers as diagnostic methods have been improved. Various methods of treatment have been used for the relief of this condition. Among the drugs used are arsenicals, Fowler's solution, arsylene "Roche" and arsacetin, iron and benzol, and tuberculin. Vaccines and serums have been used with some success and are advocated by Curschmann (2) and Coley (3). Artificial pyrexia has also been used in its treatment, and transfusions are of great value as a supportive measure. All of these methods have definite value and are still used as supportive measures, especially in locations where roentgen rays are not available. At the present time, roentgen rays are the unquestioned method of choice for the treatment of all forms of leukemia. Contributions to the literature by Sarasin (4), Sgalitzer (5), Langer (6), Leucutia (7), Keith (8), Stewart-Harrison (9), and Golden (10) give various technics of methods used.

Credit for the first treatment of leukemia with roentgen therapy seems to belong to Dr. W. A. Pusey, who reported poor results in the treatment of a case in 1902. In 1903, however, Dr. Nicholas Senn reported treating a case with roentgen rays with good results. Progress in the roentgen therapy of leukemia has been rapid since that time.

Some workers, as Piney and Riach (11) and Arnott and Gloor (12), believe that

best results are obtained by using drugs to support the roentgen rays. We are not in agreement with this, however, as a routine procedure, as it is difficult to estimate the effect of the rays alone on bone marrow, and even more difficult to estimate the effects of x-rays and drugs together.

Our series consists of 47 cases, three of the aleukemic type, 12 of lymphatic, and 32 of myeloid leukemia. Of these cases, 16 (or 34 per cent) are still living, while 31 (or 66 per cent) are dead.

The following statistical data are presented for comparative purposes:

- I. Average age our cases:
 - (a) Aleukemic cases, 23.3 years
 - (b) Leukemic cases, 47.0 years
 - (c) Myeloid cases, 38.3 years
- II. Average duration of illness:
 - (a) Aleukemic cases, 3.3 years
 - (b) Leukemic cases, 2.0 years
 - (c) Myeloid cases, 2.5 years
- III. Average duration of illness before medical aid was sought:
 - (a) Aleukemic cases, 1.5 years
 - (b) Leukemic cases, 10.5 months or 0.88 year
 - (c) Myeloid cases, 1 year
- IV. Average number of treatments:
 - (a) Aleukemic cases, 4
 - (b) Leukemic cases, 8
 - (c) Myeloid cases, 9.

While roentgen rays are the method of choice for the treatment of leukemia, there is some question as to the best manner of using these rays. It is the purpose of this paper to consider the various types and manner of treatment.

Our cases were treated by the local application of the rays, by general radiation, the so-called "spray method," and by a combination of both methods.

The spray method was first used by Dessover in 1905 and revived during the

last few years. From a study of our results, it seems that the spray method is the best form of therapy and this is also the opinion of writers such as Hunter (13), Siciliano (14), and Dale (15).

The dosage varies between 25 to 50 r units, alternating front and back. Daily treatments were usually given to alternate fields until a total of from 100 to 300 r was received, the total dose depending on the white blood count and the general condition. Irradiation was stopped when the white blood count dropped to 40,000 and no irradiation was given by any method when the count reached 20,000.

The spray method seems superior in that there is no roentgen sickness and more of the bone marrow as well as the circulating blood is irradiated. Both of these facts are due, we believe, to the comparatively low dose given at each treatment, the low total dose, thereby necessitating fewer treatments as shown by a table of comparisons. In irradiating a large area, the bone marrow shows rapid response.

Average number of treatments of cases treated by

- (a) Local method, 9
- (b) Spray method, 5
- (c) Both methods, 14.

Patients receiving spray treatments are symptom-free for longer periods of time, as the table indicates. In addition, patients treated by the spray method develop a resistance to the rays very slowly and hence can be carried over a longer period of time.

Finally, the results derived from the spray method are better than the results of local treatment or local and spray combined as the following table clearly shows:

Results of treatment by:

	Percentage Living	Percentage Dead
Local	22	78
Spray	84	16
Both	56	44

It has been suggested that the spray method might cause serious injury to the bone marrow, resulting in aplastic anemia.

We do not feel that there is any such danger from the rays when properly administered by competent radiologists, and autopsy reports such as that of Ogilvie (16) would seem to bear out our belief. If the dose is kept low and frequent blood studies made, it is not difficult to get the blood to a normal level. The spray method is, of course, contra-indicated in the aleukemic form of the disease. We do not feel that the actual life span is increased, but the useful period of life is distinctly prolonged.

The etiology of leukemia being unknown, various theories have been brought forward, notably infection, neoplasm, and hormone disturbances, but none of the theories has been substantiated. Of our 47 cases, 47 per cent gave a history of previous severe infection such as pneumonia, cellulitis, or other acute infections. Practically all the cases gave a history or showed evidence of dental caries, sinusitis, or chronic tonsillitis, but we did not count such infections in determining our figures. The percentages for the different types are as follows:

Aleukemic, 33 per cent
Lymphatic, 20 per cent
Myeloid, 57 per cent.

While these figures are not conclusive, they would seem to lend weight to the infection theory. Curschmann (2) reports two cases of chronic leukemia that showed distinct improvement during the attack of an acute infectious disease. One case had influenza and the other erysipelas. These reports would seem to support the infection theory, as would Coley's reported success with erysipelas serum.

One of our cases of myeloid leukemia became pregnant 16 months after her first x-ray treatment. Leukemia complicating pregnancy is comparatively rare.

CASE REPORT

Mrs. V. S., a 30-year-old white housewife, was first admitted to Duke Hospital on Jan. 19, 1934, complaining of loss of weight for the past eight months and of a mass in her left side of two weeks' duration. Her

general health had been good up to the onset of her present illness. In the Summer of 1933, she began to lose her appetite, whereupon she lost weight and grew steadily weaker. No new symptoms developed until Jan. 4, 1934, at which time she noticed a lump in the left side of her abdomen. The lump was not tender nor painful, but she stated that she felt a sensation of weight. The mass did not seem to increase in size. Careful questioning failed to elicit any history of chills, fever, hemorrhage from the mucous membranes or into the skin. Apparently there had been no systemic reaction other than the loss of weight and progressive weakness.

The essential features of the physical examination on admission were moderate tachycardia and evidence of weight loss. The liver margin could be felt about two fingers below the costal margin on deep inspiration. The liver edge was quite firm but not tender. The spleen was very large, extending to the mid-line and the lower edge disappeared in the left iliac fossa. The margin of the spleen was very sharp, but not nodular nor tender. There was a soft systolic murmur at the apex of the heart, which was accentuated by exercise. The remainder of the physical examination was essentially non-contributory.

Laboratory Studies.—Examination of the blood revealed a red cell count of 3,100,000; hemoglobin 68 per cent; Sahle (10.5 gm.) per 100 c.c. of blood. The white cell count was 160,000 with a marked predominance of lymphoid cells, 38 per cent lymphocytes and lymphoblasts. The red cells were thought to be somewhat pale but otherwise not abnormal. No nucleated red cells were found. The platelets were decreased, the count being 160,000 per c.mm. The basal metabolism was plus 28. Urine and stool examinations were entirely negative.

During this admission, the patient received three roentgen-ray treatments of 180 r each to the spleen on three successive days. On Jan. 24, 1934, five days after admission, the patient stated that she felt much better and refused to stay longer.

She left the hospital that day with a white blood count of 175,000.

Her follow-up was as follows:

She returned Feb. 23, 1934, stating she felt much stronger and that the mass in the left side of her abdomen was smaller. Examination showed the liver to be of the same size as on discharge, but the spleen could be felt 6 cm. below the costal margin in the left anterior axillary line. Her white blood count was 26,000 and no x-ray therapy was given.

On April 12, 1934, she returned and the liver and spleen were not palpable. White blood count was 9,850. No x-ray was given. She continued about the same for a period of six months.

On Oct. 24, 1934, she was feeling well and had gained weight. The liver and spleen were not palpable. The white blood count was 14,400. No x-ray was given. She continued well until April 2, 1935, when she returned with former symptoms. The liver was palpable 3 cm. below the costal margin and the edge of the spleen was 5 cm. below the costal margin. A mass was present in the lower abdomen, which on bimanual examination was found to be an enlarged uterus. No hemorrhage was present in the eye grounds, skin, or mucous membranes.

Laboratory Studies.—Examination of the blood revealed the red cell count to be 3,380,000; hemoglobin 74 per cent; Sahle, 11.5 gm. per 100 c.c. of blood. The white count was 34,000. No differential was reported. The platelet count was 420,000 by the method of Rees and Ecker.

Because of the patient's general condition, the pregnancy was interrupted. The patient stayed in the hospital for ten days and was discharged on April 12, 1935, with a white count of 21,600. On the day before discharge, she was given 100 r to the spleen.

While in our case, it was thought advisable to end the pregnancy, there are cases on record, as those reported by Langer (6) and Kaplan and Connery (17), in which the pregnancy was allowed to go to term and a normal infant delivered.

Oct. 19, 1935, she returned complaining

of weakness and loss of weight. The liver was not palpable. The spleen was 4 cm. below the costal margin. The white blood count was 90,000. Therapy consisting of 200 r units was given locally over the spleen. The patient continued well until Aug. 27, 1936, when the white count was 90,000. She was given 100 r to the front

of the body by the spray method and the next day another 100 r to the posterior surface of the body. She showed much improvement and was able to do her housework. In January, 1937, the white cell count had risen to 33,850 and another 100 r units was given to the anterior body surface. Since that time, the patient has

CHART I

Case No.	History No.	Age	Onset	Admission	Last Visit	Duration of Illness	High Count	Low Count	No. Treatments	Result
Aleukemic										
1	1780	33	6 mos.	11/12/30	2/16/35	4 yrs. 8 mos.	5,400	1,270	3	Died
2	15215	23	4 yrs.	6/14/32	6/28/32	4 yrs.	1,125	160	3	Died
3	47032	14	2 mos.	12/31/34	3/20/35	5 mos.	23,720	1,920	7	Living
Leukemic										
1	701	31	6 mos.	9/18/30	1/23/31	10 mos.	35,200	5,800	1	Died
2	6983	33	2 mos.	8/9/31	10/14/34	3 yrs.	34,950	20,500	4	Living
3	10813	49	19 mos.	1/25/32	4/10/34	4 yrs.	190,000	185,000	1	Died
4	13347	50	2 yrs.	4/19/32	10/20/32	2½ yrs.	115,000	16,750	10	Died
5	33719	54	3 yrs.	1/18/34	1/26/34	3 yrs.	214,000	164,000	2	Died
6	47021	62	2 mos.	12/26/34	2/18/37	2 yrs.	218,000	4,800	17	Died
7	47033	49	6 mos.	12/31/34	7/6/36	2 yrs.	275,000	29,000	32	Died
8	49376	24	2 mos.	2/23/35	4/23/35	4 mos.	146,000	20,300	5	Died
9	55778	52	6 mos.	7/25/35	8/26/35	7 mos.	158,000	7,000	3	Died
10	59428	82	1 yr.	10/27/35	2/6/37	2 yrs.	162,000	38,000	11	Died
11	63611	52	3 mos.	2/10/36	2/14/36	1 yr.	18,900	3,600	2	Died
12	65312	55	10 mos.	4/3/36	5/28/37	2 yrs.	39,000	7,600	13	Living
Myeloid										
1	2080	60	6 mos.	11/28/30	2/2/31	9 mos.	170,000	39,700	3	Died
2	2766	61	6 mos.	1/13/31	3/17/31	8 mos.	74,000	18,800	10	Living
3	7212	68	1 yr.	8/24/31	2/21/32	1 yr.	294,000	47,000	11	Living
4	10671	63	5 yrs.	1/19/32	4/28/32	5 yrs.	11,600	1,600	2	Died
5	18002	36	5 mos.	9/16/32	10/16/36	4½ yrs.	290,000	24,300	26	Died
6	18919	7	2 days	10/7/32	10/8/32	4 days	84,000	80,000	1	Died
7	19774	55	2 yrs.	10/31/32	11/5/32	2 yrs.	300,000	195,000	1	Died
8	27575	22	1 yr.	7/19/33	11/17/34	2 yrs.	359,000	3,760	25	Died
9	31699	39	2 mos.	11/13/33	4/10/37	4½ yrs.	319,000	6,100	23	Died
10	32209	50	1 yr.	11/29/33	2/9/35	2 yrs.	294,000	182,000	5	Died
11	33662	50	2 yrs.	1/12/34	7/9/34	2½ yrs.	491,000	30,000	8	Living
12	33859	30	8 mos.	1/19/34	7/14/37	4 yrs.	175,000	9,200	16	Living
13	39245	26	1 yr.	6/13/34	6/23/34	1 yr.	125,000	60,000	1	Died
14	40913	33	1 yr.	7/23/34	8/10/34	1 yr.	128,000	50,000	7	Died
15	42934	40	1 yr.	9/7/34	6/27/37	4 yrs.	409,000	9,700	36	Died
16	45411	49	1 yr.	11/5/34	8/24/36	3 yrs.	330,000	10,900	7	Living
17	46809	22	4 yrs.	12/9/34	2/19/35	4 yrs.	150,000	9,000	5	Died
18	48067	54	8 mos.	2/5/35	6/24/36	2 yrs.	200,000	18,750	3	Died
19	52364	25	2 yrs.	5/10/35	6/7/35	2 yrs.	46,320	7,220	3	Living
20	54060	16	3 wks.	6/19/35	6/28/35	1 mo.	320,000	1,450	3	Died
21	54455	42	10 mos.	6/27/35	12/12/36	16 mos.	431,000	14,800	22	Died
22	59220	20	13 mos.	10/7/35	7/28/37	3 yrs.	233,200	11,300	10	Died
23	59640	26	22 mos.	10/21/35	12/18/36	1 yr.	190,000	26,360	2	Died
24	60332	30	8 mos.	11/4/35	12/9/36	2 yrs.	380,000	8,500	8	Living
25	61376	19	2 yrs.	12/2/35	9/3/37	4 yrs.	106,000	4,200	4	Living
26	71574	64	11 mos.	8/11/36	4/5/37	1½ yrs.	93,000	3,200	5	Living
27	73615	54	6 mos.	9/21/36	6/17/37	1 yr.	37,000	2,500	3	Living
28	73798	21	1 yr.	10/7/36	6/28/37	2 yrs.	198,000	5,100	6	Living
29	73811	26	16 mos.	9/23/36	9/14/37	2 yrs.	489,000	10,400	6	Living
30	80353	43	10 wks.	2/16/37	3/21/37	3 mos.	135,000	1,950	5	Died
31	83233	41	1 yr.	4/19/37	9/3/37	1 yr.	410,000	48,000	6	Living
32	None	44	6 mos.	8/1/33	9/20/33	1 yr.	135,000	41,600	6	Died

been getting along about the same. At the time of her latest visit, April 2, 1938, her red cell count was 3,355,000 and her white cell count was 32,100. The glands in the left axilla were much enlarged and she was given 250 r units to this area.

This case is reported in detail not only because of the pregnancy occurring during the course of a chronic leukemia, but also because it shows how well these cases can be controlled by roentgen therapy and, in addition, the superiority of the spray method over the local application of the roentgen rays.

SUMMARY AND CONCLUSIONS

Chart I is a summary of our cases.

From a careful study of 47 cases of leukemia, we have concluded:

1. That roentgen rays are the method of choice for the treatment of all forms of leukemia.

2. That the so-called "spray method" is the best manner of applying rays, except for reducing the size of the spleen or the resistant superficial glands.

3. That drugs and other supportive measures should be used only as indicated and not routinely.

4. The question of interruption of pregnancy depends on the patient's general condition, as the full-term birth of a number of normal children have been reported.

BIBLIOGRAPHY

(1) CECIL: Textbook of Medicine, Second ed., page 976, paragraph on History.

(2) CURSCHMANN, H.: Remarks Regarding the Treatment of Chronic Leukemia. *Strahlentherapie*, 54, 79-82, 1935.

(3) COLEY, WILLIAM B.: End-results in Hodgkin's Disease and Lymphosarcoma Treated by Mixed Toxins of Erysipelas and *Bacillus prodigiosus* Alone or Combined with Radiation. *Trans. Am. Surg. Assn.*, 46, 331-357, 1928.

(4) SARASIN, R.: Radiation Therapy of Mediastinal Diseases in Children. *Strahlentherapie*, 57, 140-150, 1936.

(5) SGALITZER, MAX: Practical Application of General Body Exposure with Roentgen Rays in Polycythemia and Chronic Leukemia. *Strahlentherapie*, 56, 341-350, 1936.

(6) LANGER, HEINZ: Roentgen Therapy in Hyperplastic Blood Dyscrasias: New Technic for Myeloid and Lymphatic Leukemia, Polycythemia Rubra Vera, and Hodgkin's Disease. *Am. Jour. Roentgenol. and Rad. Ther.*, 34, 214-233, August, 1935.

(7) LEUCUTIA, T.: Irradiation in Lymphosarcoma, Hodgkin's Disease, and Leukemia: Statistical Analysis. *Am. Jour. Med. Sci.*, 188, 612-623, November, 1934.

(8) KEITH, D. Y.: Treatment of Leukemia. *South. Med. Jour.*, 27, 318-323, April, 1934.

(9) STEWART-HARRISON, R.: Mediastinal Tumors and Leukemia. *Acta Radiol.*, 15, 539-548, 1934.

(10) McALPIN, K. R., GOLDEN, ROSS, and EDSALL, K. S.: The Roentgen Treatment of Chronic Leukemia. *Am. Jour. Roentgenol. and Rad. Ther.*, 26, 47-65, July, 1931.

(11) PINEY, A., and RIACH, JEAN S.: The Treatment of Chronic Myeloid Leukemia. *British Jour. Radiol.*, 5, 393-427, May, 1932.

(12) ARNOTT, JULIAN, and GLOOR, W.: Results of Roentgen Treatment in Chronic Leukemias. *Strahlentherapie*, 44, 715-738, 1932.

(13) HUNTER, FRANCES T.: "Spray X-ray Therapy" in Polycythemia vera and in Erythroblastic Anemia. *New Eng. Jour. Med.*, 214, 1123-1127, June 4, 1936.

(14) SICILIANO, L.: A Contribution to Total Teleoroentgen Therapy. *Strahlentherapie*, 56, 351-353, 1936.

(15) DALE, T.: A New Method of Roentgen Treatment of Leukemia. *Acta Radiol.*, 12, 263-285, 1931.

(16) OGILVIE, ROBERTSON: Postmortem Report on a Case of Chronic Myelogenous Leukemia Treated by Radiation. *British Jour. Radiol.*, 5, 428-431, May, 1932.

(17) KAPLAN, IRA I., and CONNERY, J. E.: Pregnancy in the Course of Leukemia. *Am. Jour. Med. Sci.*, 183, 209-215, February, 1932.

INFLUENCE OF LOW TEMPERATURE ON RECOVERY FROM ROENTGEN RAYS¹

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It is well known that various cells and tissues differ markedly in susceptibility to roentgen radiations; cells in different phases of mitosis as well as tissues in various stages of differentiation show differential responses to their irradiation. The factors which influence and determine this susceptibility are not very well known, but the results of this investigation indicate that the temperature and the metabolic activity of cells after exposure to roentgen rays may be important factors in determining the amount of injury produced, *i.e.*, the effect of a given dose of roentgen rays may be diminished or enhanced according to treatment following irradiation. In this experiment temperature was the factor altered.

The material used was *Ascaris*. Eggs were taken from the anterior one-quarter inch of the uteri of *Ascaris equorum* (megaloccephalia), variety univalens, which had been kept in a refrigerator at 5° C. for not longer than thirty days. Eggs taken from this portion of the uteri were in the pronuclear stage, and developed at a very uniform rate subsequent to being placed at 25° C. All observations were made upon the living eggs by means of an ordinary high power microscope. Eggs were washed free from uterine material, placed in a normal saline solution, and evenly dispersed through the fluid.

After one hour at 25° C. the eggs were divided into control and experimental portions, *A* and *X*, respectively. At this time the experimental portion was irradiated at room temperature with a dose of 5,000 roentgens. The roentgen-ray apparatus used was a double cross-arm, mechanically

rectified unit which energized a Coolidge broad focus, universal air-cooled tube at 130 kv.p. and 5 ma. The distance was 25 cm. at which point the dose delivered was about 200 r per minute, as measured in air by means of a Victoreen dosimeter. Eggs were irradiated in a petri dish, 5 cm. in diameter, containing solution from 1 to 2 mm. in depth. The dish was supported by an ordinary roentgenographic table. Since all irradiations were made under exactly the same conditions, no attempt was made to calculate the back-scatter.

Immediately following irradiation, both the control portion *A* and the experimental portion *X* were placed at 5° C. and left there continuously throughout the experiment. At the same time that portions *A* and *X* were placed at 5° C., a small sample of eggs was taken from each and allowed to remain at 25° C. in order to observe the immediate effects of irradiation upon development. In order to determine whether temperature might in any way alter the effects of irradiation, small samples, both of control and radiated eggs, were removed to 25° C. after intervals varying from three days to six months. Observations upon cleavage were made and recorded hourly during the first 14 hours at 25° C. After one week at 25° C., embryonic development had been completed, and the number of normal and abnormal embryos was recorded. Table I lists the samples observed together with some of the results. *A*_{0 da.} and *X*_{0 da.} indicate samples taken from portions *A* and *X*, respectively; subscripts indicate length of time at 5° C. following irradiation.

The above procedure was repeated with three different lots of eggs, taken from the uteri of different worms, and results were found to be essentially the same in each

¹ Aided by a grant from the Committee on Radiations of the National Research Council and by the Rockefeller Foundation for Work on Cellular Biology.

case. Each lot contained thousands of eggs, while separate samples observed for development (as listed in Table I) always contained from 500 to 1,000 eggs. During the six months this material was kept at

used as criteria in determining the influence of low temperature on recovery.

(1) *Delay in Cleavage.*—The controls cleave in a very uniform manner. Only about forty-five minutes elapse between

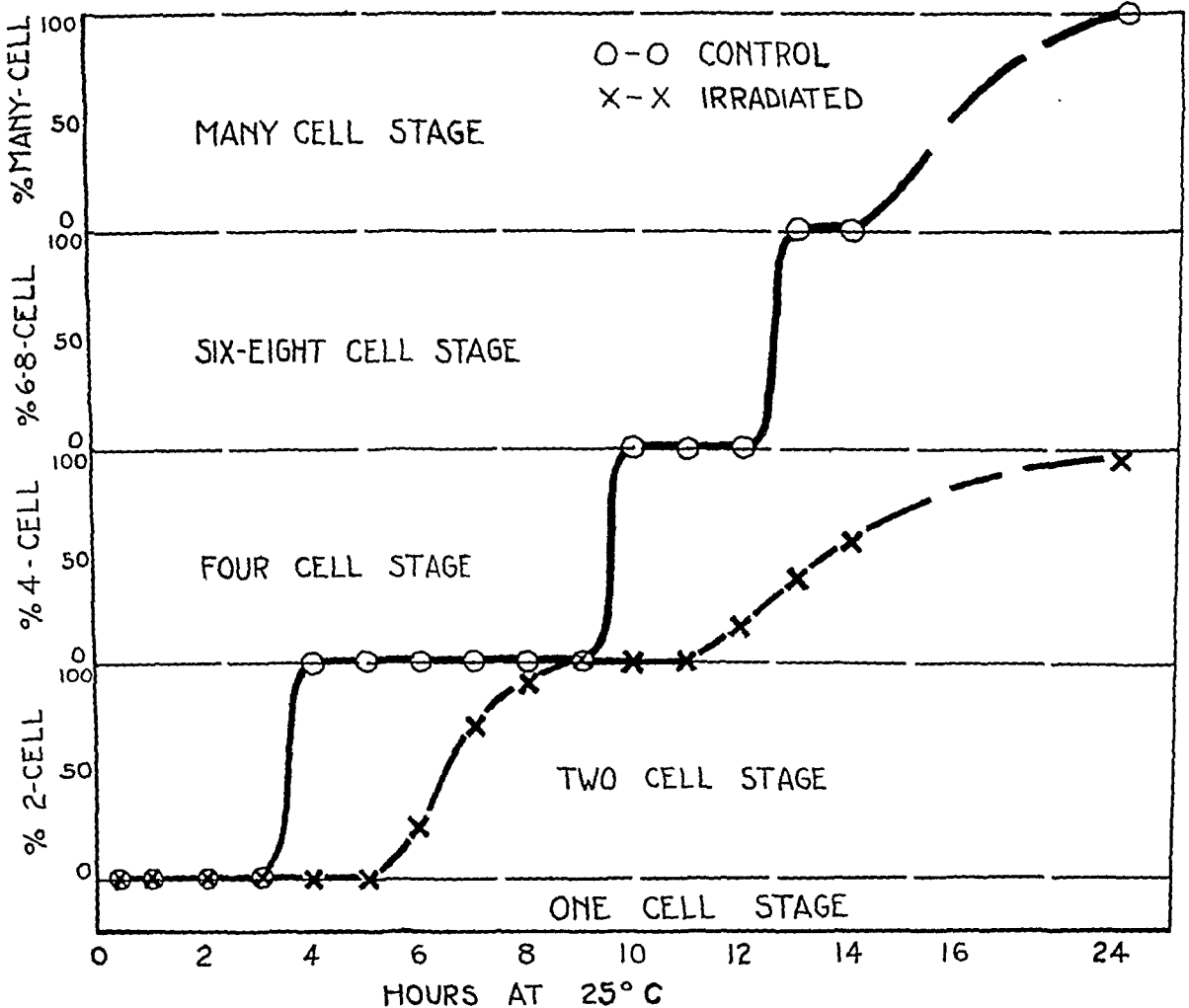


Fig. 1. Cleavage delay resulting from 5,000 r in one-cell stage. Irradiated embryos reach the many-cell stage in about 48 hours. Each O and X represents count made on a sample of from 500 to 1,000 eggs.

5° C. no deleterious effects were noted upon the controls. Samples placed at 25° C. after this interval showed the same rate and uniformity of development as was shown by the first sample.

The effect of 5,000 roentgens upon *Ascaris* eggs manifests itself in two distinct ways which can readily be observed by following their development under a microscope. These two irradiation effects were

the first appearance of division and the moment when all eggs are in the two-cell stage. However, the irradiated eggs are delayed from two to five hours. Whereas all the controls divide during the fourth hour at 25° C., the irradiated eggs divide during the sixth, seventh, eighth, and ninth hours. This is graphically represented in Figure 1. Subsequent divisions appear to be still further delayed, yet in

no case was there evidence of cell division being completely inhibited. In all the samples removed from 5° C. after various intervals, no change could be observed in rate of cleavage, all samples from the ir-

radiated groups show a very slow decrease in percentage of normal embryos.

From the data here presented, it is not possible to state whether it is the tempera-

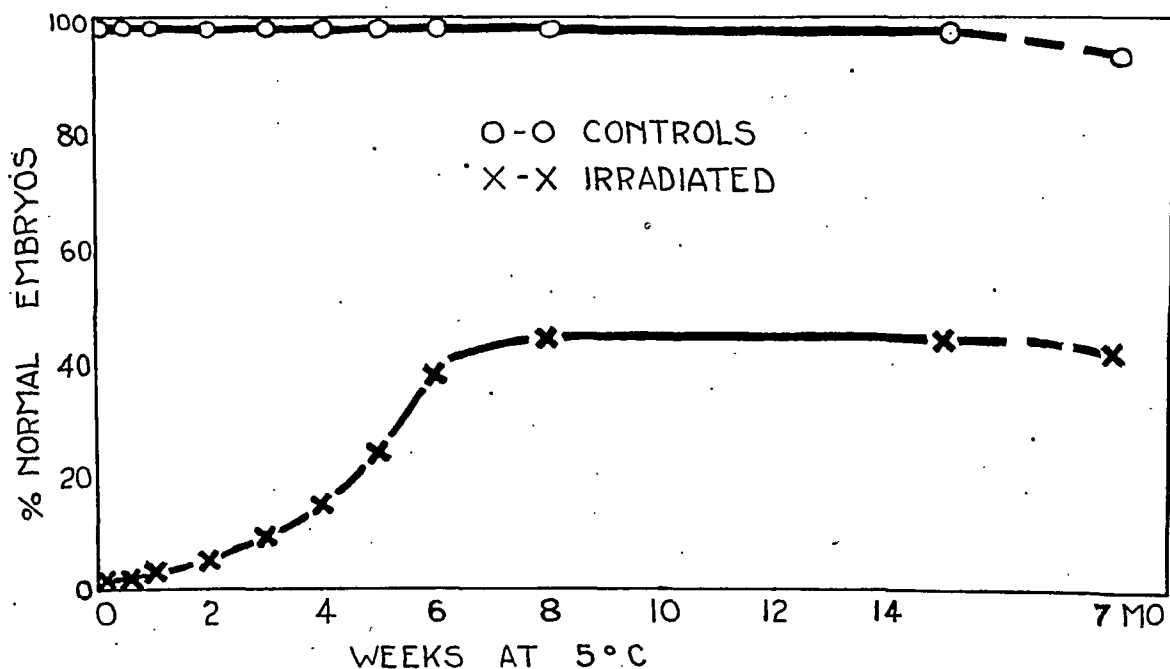


Fig. 2. Percentage normal embryos developing after varying intervals at 5° C. immediately following irradiation. Symbols represent same number as in Figure 1.

radiated group showing the same delay as represented in Figure 1. In other words, no recovery in cleavage delay resulting from irradiation was observed.

(2) *Development of Abnormal Embryos.*—After developing one week at 25° C., at least 98 per cent of the controls are in the normal-coiled embryo stage. Irradiated eggs show only from 1 to 2 per cent normal embryos; the remaining ones are abnormal, consisting of unorganized clumps of cells. However, the number of normal embryos appearing in irradiated samples increased with the length of time they had been kept at 5° C. following exposure to roentgen rays. This is shown in Figure 2. From this graph it can be seen that the maximum recovery seems to be reached in about eight weeks, after which no significant change is noted until about seven months at 5° C. After seven months,

ture factor (cold) or the inactive state resulting from cold which is the determining factor in lessening the amount of injury produced by radiations.

Experiments by Clark (1) would indicate that temperature may be the more important factor. There are also experiments in which heat is used to increase the effect of roentgen rays (2).

However, the metabolic activity of cells may also be an important factor. Strangeways and Fell (3), using tissues of embryonic fowl, found that in irradiated embryos "the degenerative changes produced in tissues by the indirect action of x-rays were greatly delayed, if not completely arrested, by maintaining the irradiated embryo at a low temperature after exposure and thus inhibiting metabolism." They conclude, therefore, that "the degenerative changes induced in tissues of six-

day embryos by x-rays are intimately related to cell metabolism, since they are inhibited or greatly retarded when metabolism is arrested by low temperature."

Ancel and Vintemberger (4), performing

cell division is checked." In his summary he states: "The activity of cells after exposure is a factor in determining the amount of injury produced."

This same idea is expressed by Evans

TABLE I.—SAMPLES PLACED AT 25° C. AFTER VARYING INTERVALS AT 5° C. FOLLOWING IRRADIATION

Samples	Description	Time at 5° C. Following Irradiation	Delay in First Cleavage	Percentage Normal Embryos Developing
A ₀ da.	Control	0 days	.....	99 ± 1 per cent
X ₀ da.	Irradiated	0 days	2-5 hours	2 per cent
A ₃ days	Control	3 days	.....	99 ± 1 per cent
X ₃ days	Irradiated	3 days	2-5 hours	3 per cent
A ₁ wk.	Control	1 week	.....	99 ± 1 per cent
X ₁ wk.	Irradiated	1 week	2-5 hours	4 per cent
A ₂ wks.	Control	2 weeks	.....	99 ± 1 per cent
X ₂ wks.	Irradiated	2 weeks	2-5 hours	6 per cent
A ₃ wks.	Control	3 weeks	.....	99 ± 1 per cent
X ₃ wks.	Irradiated	3 weeks	2-5 hours	10 per cent
A ₄ wks.	Control	4 weeks	.....	99 ± 1 per cent
X ₄ wks.	Irradiated	4 weeks	2-5 hours	15 per cent
A ₅ wks.	Control	5 weeks	.....	99 ± 1 per cent
X ₅ wks.	Irradiated	5 weeks	2-5 hours	24 per cent
A ₆ wks.	Control	6 weeks	.....	99 ± 1 per cent
X ₆ wks.	Irradiated	6 weeks	2-5 hours	38 per cent
A ₈ wks.	Control	8 weeks	.....	99 ± 1 per cent
X ₈ wks.	Irradiated	8 weeks	2-5 hours	45 per cent
A ₁₅ wks.	Control	15 weeks	.....	99 ± 1 per cent
X ₁₅ wks.	Irradiated	15 weeks	2-5 hours	44 per cent

similar type experiments, obtain similar results. These authors believe, however, that the actual amount of injury was the same in both lots, but that in the cold-treated lots it did not develop; that is, the latent period was greatly lengthened. At high temperatures when cell division was stimulated, this period was short. This is somewhat different from the opinion of Strangeways and Fell, who state that if division rate of the irradiated cells is kept at a low level after exposure, the injury not only fails to develop, but actually disappears.

Packard (5), using *Drosophila* eggs, suggests a relation between division rate and radiosensitivity. When cell division is encouraged by high temperature, the effect of irradiation is definitely injurious. "On the other hand, if by cold cells are prevented from dividing, they have a chance to recover. Apparently the reparative processes are favored by low temperatures, that is, they proceed more readily when

(6) when he states that, "in the case of the grasshopper eggs it appears that radiosensitivity, as measured by later development, was not so much a matter of the developmental condition of the embryo at the time of the irradiation as it was of the activity of the organism immediately following irradiation."

In the present experiment, the recovery from roentgen-ray injury occurs at 5° C., at which temperature there is no cleavage and metabolism must be at a minimum. This suggests the possibility that recovery (lessening of injury) may proceed in the absence of appreciable metabolism. However, it must not be confused with recovery in the sense of replacing dead cells with living ones. The recovery discussed here occurs very slowly and must take place within the living cell which is suffering from irradiation effects. In instances in which cleavage is allowed to proceed, there is not sufficient time for recovery to occur before the injury becomes permanently in-

corporated in daughter cells. However, when cleavage is inhibited by cold, partial or complete recovery may take place before development proceeds, thus resulting in a higher percentage of normal embryos.

In this connection the question arises, would recovery occur if cell division were inhibited by other agents, such as lack of oxygen, or is it also necessary to maintain a low temperature to prevent the heat changes suggested by Clark? This problem, together with the determination of a temperature coefficient of the "restorative" process, is now being investigated by the author.

SUMMARY

1. One-cell *Ascaris* eggs, when allowed to develop at 25° C. immediately after exposure to a dose of 5,000 r, showed only 1 to 2 per cent normal embryos, whereas eggs receiving the same dose, and placed at 5° C. for eight weeks, developed approximately 45 per cent normal embryos when returned to 25° C. This would indicate a significant influence of low temperature upon recovery from irradiation effects. Obviously, the embryos, both normal and abnormal, are a measure of irradiation effects upon cell division as well as upon cell differentiation. However, in this paper no attempt was made to separate the two.

2. Although it is quite evident from the

results of these experiments that recovery did occur, the delay in cleavage caused by a dose of 5,000 r was the same throughout the experiment and showed no evidence of being influenced by low temperature.

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REFERENCES

- (1) CLARK, J. H.: The Temperature Coefficient of the Effect of Radiation on Proteins and its Relation to Injury of the Living Cell. *Am. Jour. Roentgenol. and Rad. Ther.*, **40**, 501-508, October, 1938.
- (2) WARREN, S. L.: A Review of Preliminary Research upon the Combined Effects of Fever and Roentgen Radiation upon Animal Tumors. *Am. Jour. Roentgenol. and Rad. Ther.*, **36**, 983-986, December, 1936.
- (3) STRANGEWAYS, T. S. P., and FELL, H. B.: A Study of the Direct and Indirect Action of X-rays upon the Tissues of the Embryonic Fowl. *Proc. Roy. Soc. Med.*, B, **102**, 9-29, 1927.
- (4) ANCEL, P., and VINTEMBERGER, P.: Influence de l'Activite Cellulaire sur la Manifestation des Lesions Produites dans le Blastoderme de l'Oeuf de Poule par les Rayons X. *Compt. rend. Soc. de biol.*, **91**, 1425-1428, Dec. 12, 1924.
- (5) PACKARD, C.: The Relation between Division Rate and the Radiosensitivity of Cells. *Jour. Cancer Research*, **14**, 359-369, Aug. 30, 1930.
- (6) EVANS, T. C.: Respiration and Visible Development of Individual Grasshopper Eggs following X-irradiation. *Physiol. Zool.*, **7**, 556-571, Oct., 1934.

THE TECHNIC OF X-RAY TREATMENT OF OPERABLE CANCER OF THE BREAST BASED UPON AN ANALYSIS OF KEYNES' RADIUM TECHNIC

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It has been shown by Keynes (5) that survival rates equivalent to those obtainable by radical surgical methods can be obtained by radiological methods in the treatment of primary, operable

An analysis of Keynes' interstitial radiation technic in terms of the roentgen may serve, in lieu of statistical survival data, to place the technic of x-ray treatment of cancer of the breast upon a more rational basis.

Such an analysis is now valid for the roentgen has been adopted provisionally as the unit of quantity not only for x-rays but also for gamma rays (10). The intensity of radiation in terms of this unit has been found by numerous observers (2, 3, 4, 7, 11, 12) to be in the region of 8.5 roentgens the milligram element hour at a distance of 1 cm. from a point source filtered by 0.5 mm. of platinum. This value, 8.5 r/mg.-hr.-cm., will be used in this analysis. The radium-bearing needles employed by Keynes were constructed of platinum with a wall thickness of 0.5 mm. Pt and no correction for this factor is necessary.

The theory that doses of 200 kv. roentgen and gamma rays, which are equivalent in terms of the physical constant, the roentgen, are equivalent in terms of biological reactions is not accepted by all. It should be emphasized, however, that results published by those who do not accept this theory are not consistent. This applies especially to the value in roentgens of the threshold erythema dose. This dose, as determined by Quimby (9), is 525 r (measured in air) for 200 kv. x-rays filtered by 0.5 mm. Cu and 1.0 mm. Al delivered at the rate of 60 r/min. to a 10×10 cm. field, 50 cm. distant from the tube target. This dose as estimated by Failla (1) for gamma rays is 1,010 r which is considerably higher. If one considers Quimby's (9) tables of millicuries in radon seeds required to deliver specified doses to masses of various diameters, then the results are again different. For example, the millicuries re-



Fig. 1. The usual distribution of radium-bearing needles in a characteristic case of carcinoma of the breast. (Keynes.)

cancer of the breast. This applies, however, only to interstitial radiation and not to external radiation technics. The result is that the present methods of external radiation of cancer of the breast are based largely upon the limitations imposed by the tolerance of normal tissues, especially the skin, rather than upon a more rational basis. This concept of normal tissue tolerance itself cannot, at present, be defined in terms of physical or other constants.

quired to deliver 1 T.E.D. to masses of various diameters is:

d (cm.)	mc./T.E.D.
2	2.9
3	5.4
4	9.0

But the T.E.D. in terms of the roentgen, using the value 8.5 mg.-hr.-cm., will be, for the values listed above:

d (cm.)	mc./T.E.D.	T.E.D. (r)
2	2.9	820
3	5.4	678
4	9.0	636

These values are consistent neither with Failla's value of 1,010 r nor with the in-

fore, valid where such distances are concerned. The gamma-ray doses described above include scattered radiation. The variation between Quimby's data for x-rays and gamma rays becomes less significant if scattered radiation is added to the T.E.D. of 525 r for x-rays. This scattered radiation would be of the order of 30 per cent, and the T.E.D. for 200 kv. roentgen rays, including scattered radiation, would be 682 r, a value even greater than that of 678 r listed in the table for radon at a distance of 3 cm. This latter value of 678 r and the value 636 r for the 4 cm. distance are very much less than Failla's value of 1,010 r but are in general agreement with the value 682 r for 200 kv. x-rays.

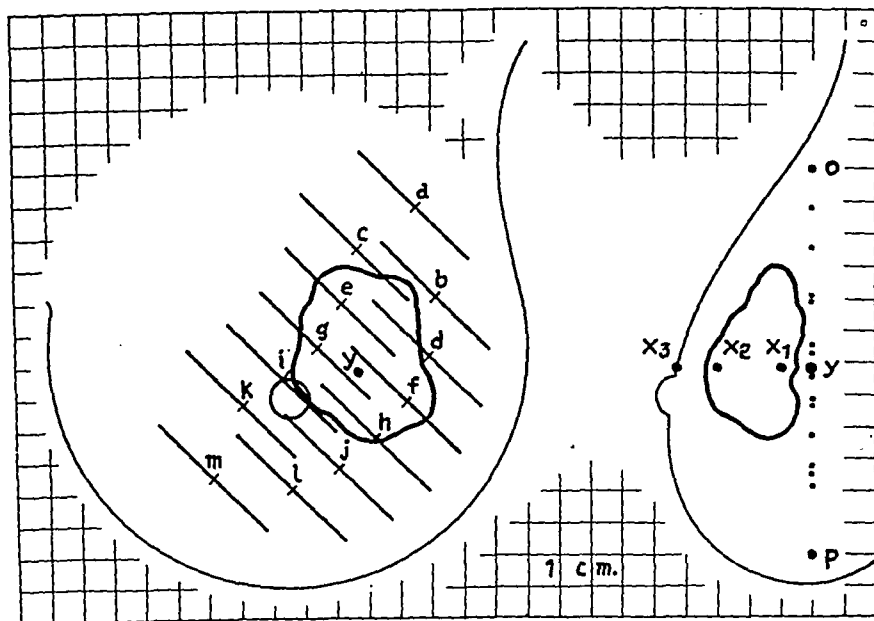


Fig. 2. Diagram of breast containing the actual average number of radium-bearing needles upon which this analysis is based. The needles are considered as point sources. The distance from the center of any needle to any point x can be determined by the law of right-angled triangles. The dose, in terms of the roentgen, at any point x can be determined for each needle. The sum of these doses is

$$\begin{aligned} Dx_1 &= 6,991 \text{ r} \\ Dx_2 &= 3,149 \text{ r} \\ Dx_3 &= 1,988 \text{ r} \end{aligned}$$

(For complete explanation, see text.)

verse square law. This latter is especially significant when it has been shown by Glasser and Rovner (3) that radium sources, even as long as 1 cm., behave as point sources at distances greater than 2 cm., and that the inverse square law is, there-

There is clinical evidence (8) that the biologic effectiveness of 200 kv. roentgen and gamma rays is the same. On the bases of this evidence, and the general agreement of Quimby's threshold erythema doses for x-rays and gamma rays, it is accepted for

the purposes of this analysis that doses of x-rays and gamma rays which are equivalent in terms of the roentgen are also equivalent in their biologic reactions.

The technic of radium-needle implanta-

3 mg. needle in each of its four walls, the needles converging toward the apex of the axilla. The infra and supraclavicular regions are irradiated by placing two 2 mg. needles, of an active length of 3.2

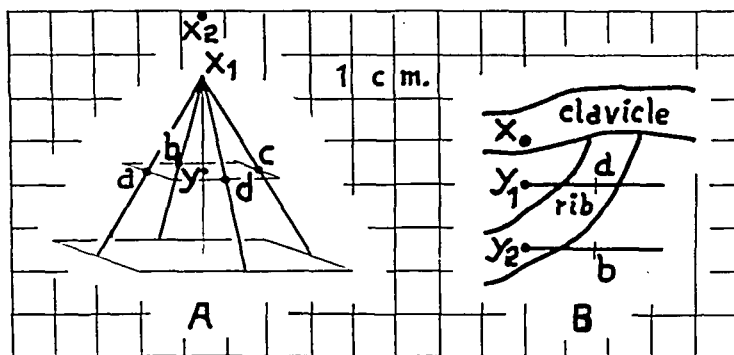


Fig. 3. Diagram showing distribution of radium-bearing needles in the axilla (A). Each needle is considered as a point source (a, b, c, d). The total dose, in the terms of the roentgen, is

$$Dx_1 = 2,975 \text{ r}$$

$$Dx_2 = 1,127 \text{ r.}$$

Diagram showing distribution of radium-bearing needles in the subclavicular region (B). Each needle is considered as a point source (a, b). The dose at point x is

$$Dx = 1,126 \text{ r.}$$

(For complete explanation see text.)

tion in the treatment of cancer of the breast has been described by Keynes in great detail (6). A short review of this technic is necessary. It resolves itself into the treatment of two main areas—the primary growth and breast, and the accessible lymphatic areas. The primary growth and entire mammary gland are irradiated by 3 mg. Ra element needles, of an active length of 4.8 cm. filtered by 0.5 mm. Pt, implanted 1.5 cm. apart in a single plane deep to the mammary gland itself—that is, in the plane of the pectoral fascia. Penetration of the mass itself by the needles is avoided although in thick breasts it sometimes is necessary to employ two layers of needles, one layer lying superficial to the primary tumor. The entire mammary gland is irradiated because of the frequency of "secondary deposits" in the breast itself. No gap of untreated breast is left between the tumor and the anterior fold of the axilla.

The axilla is irradiated by placing one

cm., beneath and two 2 mg. needles above and parallel to the middle third of the clavicle. A similar 2 mg. needle is placed in each of the upper four parasternal intercostal spaces. The great infrequency of metastases in the parasternal intercostal spaces justifies the elimination of this last procedure as a routine one and the presence of palpable nodules in the supraclavicular region would place such a case in the inoperable group, and, therefore, outside the scope of this paper. The irradiation of the primary tumor, the breast, the pectoral fold, and the axilla only will, therefore, be considered as within the scope of this analysis.

Figure 1, from Keynes, shows the usual distribution of radium-bearing needles in a characteristic case.

The individual technic employed in the treatment of 171 patients is described by Keynes (6). Ninety-nine of this group of 171 were found to conform to each other in each of the following standards:

1. Both the breast and lymph areas were treated.
2. The treatment time was 168 hours.
3. Treated not more than once.

This group of 99, rather than Keynes' diagram, was used in order to determine what the actual average dose was. This average dose was found to be different from that shown in the schematic diagram (Fig. 1). The average dose in the breast was found to be 39 mg. \times 168 hours which is equivalent to 3 mg. (the standard needle) \times 13 (number of needles) \times 168 = 6,552 mg.-hr. The average dose in the lymph areas was found to be 27 mg. \times 168 hours, which is practically equivalent to the technic shown in Figure 1, that is:

Region	No. needles	mg./needle	Total amt. (mg.)
Axilla	4	3	12
Infracavicular	2	2	4
Supracavicular	2	2	4
Intercostal spaces	4	2	8
			<hr/> 28

In the analysis of this technic in terms of the roentgen the average dose of radium administered to the breast of average size will be that stated above, *i.e.*, $3 \times 13 \times 168 = 6,552$ mg.-hr. The average dose administered to the axilla will be (including axilla and infracavicular region) $16 \text{ mg.} \times 168 = 2,688$ mg.-hr. These doses do not allow for any radium in the pectoral fold as was stressed in the description of the technic. This would tend to make any error in the estimation of doses in roentgens to the breast and lymph areas in the direction of a greater dose than may actually be the case. The analysis should, therefore, be even more valid.

A diagram (Fig. 2) of a breast 15 cm. in diameter and about five centimeters in thickness was drawn and a tumor mass was sketched in. The average number, 13, of 3 mg. needles was drawn in. These needles are in the positions recommended by Keynes, that is, 1.5 cm. apart, with some overlapping of the point ends, in the plane of the pectoral fascia. These needles are labeled *a, b, c, —m; o-p* is the plane

of the pectoral fascia in which the needles are deposited; x_1, x_2 , and x_3 are points within or on the surface of the breast, and y lies perpendicularly beneath x in the plane of the pectoral fascia.

Employing the value 8.5 r for the intensity of radiation, the mg.-hr. at a distance of 1 cm. from a 0.5 mm. Pt filtered point source then the intensity, I , at any distance, r , is

$$I_r = \frac{8.5}{r^2}$$

and the dose, D , in roentgens for a 3 mg. needle in 168 hours at any distance, r , is

$$D_r = \frac{8.5 \times 3 \times 168}{r^2} = \frac{4284}{r^2}.$$

The needles are considered as point sources, the points being located at the center of each needle.

Referring to Figure 2:

$$r^2 = (ax)^2, (bx)^2, (cx)^2, \dots (mx)^2$$

and

$$(ax)^2 = (xy)^2 + (ay)^2$$

$$(bx)^2 = (xy)^2 + (by)^2$$

$$(cx)^2 = (xy)^2 + (cy)^2, \text{ etc.}$$

The total dose in roentgens at any point, x , in the breast for the 13, 3 mg. needles in 168 hours is

$$D_x = \frac{4284}{(xy)^2 + (ay)^2} + \frac{4284}{(xy)^2 + (by)^2} + \frac{4284}{(xy)^2 + (cy)^2} \dots + \frac{4284}{(xy)^2 + (my)^2}$$

These values, xy, ay, by , etc., were determined by actual measurement¹ on the enlarged figure using the center of each needle as a point source. No attempt was made to estimate scattered radiation. Using this method the dose at any point can be determined. Under these conditions the doses at points x_1, x_2 , and x_3 are

¹ These values are as follows: $x_1 - y$ 1.0; $x_2 - y$ 3.0; $x_3 - y$ 4.3; $a - y$ 5.5; $b - y$ 3.4; $c - y$ 3.8; $d - y$ 2.3; $e - y$ 2.2; $f - y$ 1.8; $g - y$ 1.5; $h - y$ 2.2; $i - y$ 2.4; $j - y$ 3.1; $k - y$ 3.3; $l - y$ 4.2, and $m - y$ 5.6 cm.

$$\begin{aligned}D_{x_1} &= 6,991 \text{ roentgens} \\D_{x_2} &= 3,149 \text{ roentgens} \\D_{x_3} &= 1,988 \text{ roentgens.}\end{aligned}$$

D_{x_1} is the maximum dose received by the tumor; D_{x_2} is the dose received by the periphery of the tumor, and D_{x_3} is the dose received by the skin. For the purposes of the discussion, D_{x_1} will be considered to be 7,000 r; D_{x_2} , which is about the minimum dose received by the tumor, 3,000 r, and D_{x_3} , 2,000 r.

The determination of dosage in the axilla is a more difficult problem and only an approximation of it can be made. The axilla can be considered as a four-sided pyramid with each wall of the axilla representing one side of the pyramid. A needle in each wall of the axilla will lie along the sides of the pyramid as shown in Figure 3-A. The ends of the needles converge at the apex of the pyramid. If each needle is considered as a point source, the point being at the center of the needle (a, b, c, d), then the dose at the point x_1 , of convergence of the needles, will be

$$D_{x_1} = \frac{4(8.5 \times 3 \times 168)}{r^2} = \frac{17,136}{r^2}$$

and

$$r^2 = (ax_1)^2, (bx_1)^2, \text{ etc.} = (2.4)^2 \text{ cm.}$$

and

$$D_{x_1} = \frac{17,136}{(2.4)^2} = 2,975 \text{ roentgens.}$$

The dose at D_{x_2} , which is only 1.5 cm. higher in the axilla than D_{x_1} , will be about

$$D_{x_2} = \frac{17,136}{(3.9)^2} = 1,127 \text{ roentgens.}$$

Figure 3-B shows the arrangement of needles in the subclavicular region which may be considered the apex of the axilla. The two 2 mg. needles with active lengths of 3.2 cm. are considered as point sources, the points being at a and b . The dose at point x , which is the highest point in the axilla, is

$$D_x = \frac{8.5 \times 2 \times 168}{r^2} = \frac{2,856}{r^2}$$

$$r^2 = (ax)^2, (bx)^2$$

$$(ax)^2 = (xy_1)^2 + (ay_1)^2$$

and

$$(bx)^2 = (xy_2)^2 + (by_2)^2$$

$$D_x = \frac{2,856}{(xy_1)^2 + (ay_1)^2} + \frac{2,856}{(xy_2)^2 + (by_2)^2}$$

$$D_x = 1,126 \text{ roentgens.}$$

In review of the data, then, it is found that the minimum dose to the tumor of the breast is about 3,000 roentgens and the dose to the axilla is between 1,200 roentgens at its apex and 3,000 roentgens near its base. These are the doses, from interstitial irradiation with radium-bearing needles, with which survival rates equal to those obtained by surgical methods have been secured. It would follow, therefore, that the same survival rates might be secured by external irradiation with x-rays provided that equivalent minimal tumor and axillary doses are administered. This, of course, demands further proof but these doses should at least serve as a standard of adequate irradiation.

Such doses can be matched and in some instances even exceeded by external irradiation with the use of cross-fire methods. In the breast shown, which is 15 cm. in diameter, the dose at a point in the center of the breast, 7.5 cm. from the edge, would be 45 per cent³ for 200 kv. x-rays of a quality of 1.0 mm. Cu H.V.L. and a field 11×9 cm. In the actual radiation of the breast the organ can, however, be somewhat compressed or the rays so directed that this distance may be considerably shorter and the depth dose, therefore, greater. The depth dose under these conditions can be considered to be 50 per cent.

² $xy_1 = 1$ cm.

$xy_2 = 2.5$ cm.

$ay_1 = 1.6$ cm.

$by_2 = 1.6$ cm.

³ Depth doses in this part of the discussion from Quimby's data (9).



Fig. 4. Operable carcinoma of the breast 11 days after x-ray irradiation according to the technic derived from the analysis of Keynes' radium technic. Treatment time: 19 days. Dose: Medial breast port, 12×7 cm. 3,500 r; Lateral breast port, 11×9 cm. 3,750 r; Axillary port, 7 cm. diameter 5,650 r. (All doses as measured in air.)

If the breast can be radiated from both sides and the depth dose in the center of it is 50 per cent then skin doses of 3,000 r at each port are necessary to administer a dose of 3,000 r to the center.

In order to deliver a dose of 3,000 r to a point about five centimeters deep to the skin surface in the axilla through a port 7 cm. in diameter, a dose of about 6,000 r (measured in air) would be necessary, for the depth dose under these conditions is somewhat less than 50 per cent. The dose in the apex of the axilla could be augmented by a small subclavicular field, with a comparable dose, just as radium is used in this region.

It is important to note that the radium treatment was given in eight days but, for comparable doses, the administration of the x-ray irradiation in a period of less



Fig. 5. Photomicrograph of edge of irradiation reaction of the type shown in Figure 4. There is complete destruction of the epidermis and acute and chronic inflammation of the corium.

than 20 days is hardly practically possible. It should be noted also that no account of the scattered radiation has been taken. No account of scattered x-ray radiation has been taken because that for gamma radiation in tissue is not known and no account of it was made in the analysis. The variation in the time factor between the two technics is an undetermined influence. The prolongation of the treatment period with x-ray irradiation may be compensated for by the probability that the dose from external irradiation may actually be greater, for the doses described, than that from interstitial irradiation because the contribution of scattered radiation from 200 kv. x-rays is probably greater than that from gamma rays.

Figure 4 is a case of operable carcinoma (aspiration biopsy) of the left breast 11 days after irradiation. The breast tumor was located in the upper outer quadrant and was 5 cm. in diameter. The breast itself was about 15 cm. in its transverse diameter. There was a hard node 1.5 cm. in diameter in the axilla. The breast and axilla were treated according to the technic derived from this analysis. The duration of treatment was 19 days. Two breast ports, 12×7 cm. on the medial aspect and 11×9 cm. on the lateral aspect, were used. The latter one included some of the pectoral fold and there was slight

overlapping of them. The doses applied to these fields were 3,500 r (measured in air) to the medial and 3,150 r to the lateral field. In addition, 600 r was given through a 7 cm. in diameter port located in the lateral breast field directly over the tumor, making a total dose of 3,750 r to this area.

A single axillary port 7 cm. in diameter, which extended from the anterior to the posterior axillary walls was employed and the total dose to this field was 5,650 r (measured in air). It is considered that this single-port method is a more advantageous one than the multiple-port technic in the irradiation of the axilla because with the latter method the reactions are widespread and occur on the posterior and lateral axillary walls which do not need

to be irradiated. With the single-field method, only the axillary contents themselves are irradiated. The dose at the apex of the axilla can be augmented by irradiating through a small subclavicular port.

The reaction produced by such a technic is very severe, as is shown in Figure 4. It does not, however, exceed normal tissue tolerance, as the damage induced is not irreparable. The reaction is of the type shown in Figure 5 which is a photomicrograph of the edge of an irradiated field. There is complete destruction of the epidermis and acute and chronic inflammation of the corium. Occasional small islands of epidermis are left, as shown in Figure 6, and from these, as well as from the epidermis at the periphery of the reaction, re-



Fig. 6.



Fig. 7.

Fig. 6. Twenty-four days after x-ray irradiation. Small islands of epidermis have been preserved in the medial breast field. Replacement of the epidermis results from the proliferation of these islands as well as from the proliferation of the epidermis at the periphery of the reaction.

Fig. 7. Forty-four days after x-ray irradiation. Reaction healed except at lateral breast and axillary fields, the sites of the largest doses.

placement of the epidermis occurs. No such islands of epidermis are left at the site of the largest doses, that is, immediately over the tumor and in the axilla. Here replacement of this epidermis must take place from the edges.

This type of reaction is painful during the first two weeks of its presence and uncomfortable until healed. An ointment, such as the following,

Ung. Zn. Ox. (20 per cent U.S.P.)	1/
Petrolatum	1/
Metacaine	1/1,000

will control the symptoms but the ointment itself may become irritating with use.

The healing of this kind of reaction is very prolonged. Figure 4 shows the height of the reaction 11 days after the completion of the irradiation, Figure 6 the healing stage at 24 days, and Figure 7 the healing stage at 44 days. Restitution of the epidermis was complete, with the exception of some crusting of the lateral aspect of the breast, at the end of 90 days. The patient is living, without evidence of metastases or recurrence, one year after starting treatment, but the crusting of the breast persists. This period of reaction, until restitution of the epidermis is complete, is a long one of discomfort; the lesions require daily dressings, and the persistence of the reaction tends to discourage the patient. These sequelæ should be compared with the short, ten day, post-operative course after radical mastectomy, during which time the patient is quite comfortable.

It is recognized, of course, that a technic of combined interstitial and external irradiation could be formulated on the basis of the analysis here presented. Such a technic would not be accompanied by such a severe cutaneous reaction and it is conceivable that the distribution of radiation in breast and axilla might be better than with interstitial irradiation alone.

CONCLUSIONS

1. There are, at present, no criteria based upon statistical survival data upon

which to base a concept of adequate dosage in the external irradiation treatment of operable carcinoma of the breast.

2. Keynes' data, based upon the interstitial irradiation of breast cancer, provide such a criterion assuming that a direct comparison in terms of the roentgen can be made.

3. An analysis of Keynes' technic for the irradiation of the breast and axilla, in terms of the roentgen, was made. The minimum dose in the breast was found to be 3,000 r and that in the axilla from 1,200 to 3,000 r.

4. The doses of x-ray necessary to deliver comparable minimal doses to the breast and axilla were found to be at least 3,000 r through each of two lateral breast ports and about 6,000 r through a single port in the axilla. Such radiation, to be comparable, should be delivered within 20 days.

5. A case illustrating this technic is presented. The reaction resulting from such treatment is so severe that the method should be employed in the treatment of operable breast cancer only if there are the strongest contra-indications to a radical mastectomy. The technic can, however, be modified so as to be suitable for any inoperable or recurrent breast cancer problem.

6. If, however, radical mastectomy is not possible and x-ray radiation is employed as the treatment of choice, no radiation technic should be considered adequate which does not deliver, in a short time, a minimum dose of 3,000 roentgens to any point in the breast and axilla.

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BIBLIOGRAPHY

- (1) FAILLA, G., and MARINELLI, L. D.: The Measurement of the Ionization Produced in Air by Gamma Rays. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 312-343, August, 1937.
- (2) FRIEDRICH, WALTER: The Measurement of Gamma Rays. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 69-79, July, 1938.
- (3) GLASSER, O., and ROVNER, L.: Dosimetry in Radiation Therapy: Gamma-ray Measurements in Roentgens. *Am. Jour. Roentgenol. and Rad. Ther.*, 36, 94-104, July, 1936.

(4) KAYE, G. W. C., and BINKS, W.: The Ionization Measurement of Gamma Radiation. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 80, July, 1938.

(5) KEYNES, GEOFFREY: The Place of Radium in the Treatment of Cancer of the Breast. *Ann. Surg.*, 106, 619-630, October, 1937.

(6) Idem: The Radium Treatment of Carcinoma of the Breast. *British Jour. Surg.*, 19, 415-480, January, 1932.

(7) MAYNEORD, W. V., and ROBERTS, J. E.: An Attempt at Precision Measurements of Gamma Rays. *British Jour. Radiol.*, 10, 365-388, May, 1937.

(8) PATERSON, R., and PARKER, H. M.: A Dosage System for Gamma Ray Therapy. *British Jour. Radiol.*, 7, 592-632, October, 1934.

(9) QUIMBY, EDITH H.: Notes on the Physics of Radiation Therapy. Published by the Author, New York, 1937.

(10) Recommendation of the International Committee for Radiological Units (Chicago, 1937). *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 295-298, February, 1938.

(11) ROVNER, LEOPOLD: Measurements of Radiation Energy and True Tissue Dosage (Energy Absorption) in High Voltage Therapy. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 104, July, 1938.

(12) ZIMMER, KARL G.: Radium Dosimetry. George Thieme, Leipzig, 1936.

THE VALUE OF ROENTGEN EXAMINATION OF THE PARANASAL SINUSES¹

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THE widespread employment of roentgen methods in the examination of paranasal sinus disease suggests that these methods are of considerable practical value. In an effort to determine to what

records were promptly discarded because of inadequate clinical information or inconclusive roentgen findings, leaving the records of 854 patients in which were recorded, in close sequence, definite opinions

TABLE I.—DESCRIPTION OF CASE MATERIAL

Case records reviewed	1,000
Deleted (lack of specific information)	146
Total patient group studied in detail (Clinical statement available in each case)	854
Sex distribution: Female	345
Male	509
Age distribution: Years	
0-9	55
10-19	178
20-29	162
30-39	158
40-49	157
50-59	102
60-69	29
70-79	12
80-89	1

TABLE II.—BASIS FOR EXAMINATION OF SINUSES

Localized or specific symptoms	143
Generalized or non-specific symptoms	554
Combined specific and non-specific symptoms	157
Total	854

extent this assumption is correct, roentgenologic and clinical observations regarding the sinuses have been reviewed in a considerable number of case records. Roentgenologic impressions have been compared with symptoms, physical signs, and, where available, operative findings.

At the University Hospital during the two-year-period ending June 30, 1936, 1,248 patients were referred to the Department of Roentgenology for examination of the paranasal sinuses. This group represents 1.8 per cent of all diagnostic procedures conducted by the Department during the 24-month interval. Records of 1,000 consecutive cases of suspected sinus disease were withdrawn from files for this period. One hundred and forty-six of these

from the Departments of Otolaryngology and Roentgenology.

Patients of both sexes and various ages are represented, as shown in Table I. Some of these patients were referred for roentgen examination of the sinuses because of symptoms directly referable to the upper respiratory tract, others because of less specific symptoms, perhaps explainable on the basis of sinus disease, and still others in which such specific and non-specific symptoms were combined (Table II). The relatively small group referred because of localizing symptoms, such as pain on pressure, rhinorrhea, swollen nasal mucosa, and acute headache is explained by the fact that such signs of acute sinusitis scarcely require confirmatory proof and as a rule quickly disappear as the result of expectant treatment. It is when local symptoms persist beyond the acute stage that the rhinologist is most desirous of roentgen consultation.

At the University of Michigan, routine examination of the paranasal sinuses consists of four projections—Waters, Rhese, vertico-mental, and lateral—recorded with the aid of apparatus especially designed for skull radiography. The Waters and

¹ Read at the Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

In 15.5 per cent of the cases accepted for this survey operative proof was available (Table IV). These are, of course, selected cases with sound reasons for surgical treatment. Only occasionally were roentgeno-

The roentgenologist's ability to report the exact location of recognizable sinus abnormality is related directly to his ability to visualize at one sitting the entire system of air-containing cells in each indi-

TABLE VI.—FREQUENCY OF VARIOUS ROENTGEN FINDINGS RELATED TO THE 5,978 INDIVIDUAL SINUS CAVITIES IN 854 PATIENTS EXAMINED

	Frontal		Ethmoid		Maxillary		Sphenoid	Percentage of Total
	R	L	R	L	R	L		
Anomaly	14	14	...	...	...	...	2	0.51
Clouding (simple)	98	104	141	138	186	201	81	15.86
Clouding and sclerosis	11	9	2	2	5	5	3	0.62
Clouding and bone destr.	5	6	1	1	5	3	...	0.36
Thickened mucous membrane	65	65	116	118	248	233	91	15.67
Thickened m.m. and sclerosis	2	2	...	...	...	...	...	0.07
Thickened m.m. and polyp	1	1	...	...	14	9	...	0.42
Polyp only	...	...	...	...	7	13	...	0.34
Expansion (tumor)	...	...	2	1	8	3	4	0.31
Fracture	...	...	...	...	4	5	...	0.11
Post-operative defect	2	4	3	5	4	4	2	0.41
Total abnormal	198	205	265	265	481	476	183	34.68
Normal	656	649	589	589	373	378	671	65.32

logic or physical findings in error. In but a single instance did surgical exploration fail to confirm pre-operatively diagnosed disease.

Judged purely as a means of recognizing disease, roentgen methods are to-day accepted as essential in examination of the chest. This is true because many significant intrathoracic lesions yield few, if any, reliable symptoms or signs. The present review supplies no basis for a similar conclusion regarding the value of radiographic procedures in paranasal sinus examination. On the contrary few, if any, instances of sinus disease have been recognized by such measures alone. It is in the matter of determining the location and extent of lesions involving the sinuses, as well as in the matter of adding leading information as to the nature of the disease process known to exist, that roentgenologic examination in this particular field proves its worth.

TABLE VII.—INDIVIDUAL SINUSES EXPLORED IN 132 PATIENTS OPERATED UPON

Unilateral maxillary	62
Bilateral maxillary	26
Unilateral frontal, ethmoid, maxillary, and sphenoid	7
Unilateral ethmoid and maxillary	4
Unilateral frontal	4
Unilateral ethmoid, maxillary, and sphenoid	4
Unilateral ethmoid	3
Bilateral frontal	2
Unilateral frontal and ethmoid	2
Sphenoid	2
Bilateral ethmoid, maxillary, and sphenoid	2
Unilateral frontal, ethmoid, and maxillary	2
Unilateral frontal and maxillary; bilateral ethmoid and sphenoid	2
Bilateral frontal; unilateral ethmoid, maxillary, and sphenoid	2
Bilateral ethmoid and frontal	1
Bilateral ethmoid and unilateral maxillary	1
Bilateral ethmoid and maxillary	1
Unilateral frontal, ethmoid, and sphenoid	1
Unilateral frontal and ethmoid; bilateral maxillary and sphenoid	1
Unilateral frontal; bilateral ethmoid, maxillary, and sphenoid	1
Left ethmoid, right maxillary and sphenoid	1
Unilateral frontal and maxillary; bilateral ethmoid and sphenoid	1

vidual patient. Again it should be emphasized that his ability in this direction is necessarily exceedingly limited unless he is supplied with roentgenograms of fine technical quality. Table V shows clearly the

(65.32 per cent) of these sinus chambers were found to present normal appearances from the roentgen viewpoint. Signs of disease, when present, were encountered most frequently in the maxillary antra,

TABLE VIII.—SIGNIFICANCE OF ROENTGEN SIGNS OF SINUS DISEASE

I. "Simple Clouding"

Operative Findings (163 Sinuses)	Frontal		Ethmoid		Maxillary		Sphenoid	Total
	R (6)	L (9)	R (11)	L (22)	R (47)	L (54)	(14)	
Soft Tissues								
Normal					1	1	2	4
Pus	2		3	2	27	26	3	63
Pus and thickened mucous mem- brane		7	6	14	14	20	6	67
Thickened mucous membrane	1		2		1		2	6
Polypoid mucous membrane	3	2		1	3	5	1	15
Neoplasm, benign						1		1
Neoplasm, malignant				5	1	1		7
Bone								
No statement	4	7	8	16	42	50	13	140
Normal	1		3		2	2	1	9
Osteitis		1		2	3			6
Osteomyelitis	1	1				1		3
Malignant invasion				4		1		5

great variability to be expected in the pattern of sinus involvement and incidentally indicates to what extent the roentgenologist can localize signs of disease.

In each set of sinus roentgenograms a great number of individual air cells may be recognized. The actual number varies in different individuals but in general one may consider that in the case of each patient seven more or less well-defined individual sinuses are available for study. The frontals, the ethmoid groups, and the maxillary antra are easily divided into bilateral pairs, while the individual sphenoid cells can conveniently be considered as one chamber. It may then be considered that 5,978 individual cavities were observed in the course of reporting roentgen findings on the present group of 854 patients. Thus considered, it is found that over one-half

less frequently in the ethmoids, and still less frequently in the frontal and sphenoid sinuses. Table VI records not only the frequency of abnormal findings by sinuses, but also according to the 11 classifications of abnormality recognizable by roentgen methods. By far the most frequent roentgenologic evidence of disease was found to be clouding or non-aeration of a normally transparent sinus cavity or thickening of the mucosal lining of a sinus. All other individual signs of abnormality appeared with frequencies of less than 1 per cent.

"Clouding," as reported by the roentgenologist, is a useful term to indicate loss of air content. Although it is sometimes possible to state with certainty that loss of air content has resulted in a specific instance as the result of the accumulation of fluid, it must always be borne in mind that

tremendous swelling of mucosal lining can result in the complete obliteration of air space; that the sinus may be completely filled with neoplasm, or that, instead of the accumulation of exudate in large

it becomes obvious that several of the already mentioned causes for clouding may coexist and may or may not be individually detectable.

Abnormal roentgenologic findings which

TABLE IX.—SIGNIFICANCE OF ROENTGEN SIGNS OF SINUS DISEASE
II. "Clouding with Bone Destruction"

Operative Findings (13 Sinuses)	Frontal		Ethmoid		Maxillary		Total
	R (3)	L (4)	R (1)	L (1)	R (2)	L (2)	
Soft Tissue							
Normal	1						1
Pus		1					1
Pus and thickened mucous membrane	1	2					3
Polypoid mucous membrane		1					1
Neoplasm, malignant	1		1	1	2	2	7
Bone							
No statement					1		1
Osteomyelitis	2	4					6
Malignant invasion	1		1	1	1	2	6

TABLE X.—SIGNIFICANCE OF ROENTGEN SIGNS OF SINUS DISEASE
III. "Thickened Mucous Membrane Lining"

Operative Findings (37 Sinuses)	Frontal		Ethmoid		Maxillary		Sphenoid	Total
	R (1)	L (2)	R (2)	L (3)	R (16)	L (11)	(2)	
Soft Tissue								
Normal		1			1	1		3
Pus	1			1	6	5		13
Pus and thickened mucous membrane		1	2	2	6	2	2	15
Thickened mucous membrane					1	2		3
Polypoid mucous membrane					2			2
Neoplasm, malignant						1		1
Bone								
No statement	1	2	2	2	13	10	2	32
Normal					1	1		2
Osteitis					1			1
Osteomyelitis				1	1			2

quantities, abnormal fluid content of sinus cavities may represent whole blood. When clouding is particularly dense, it may become quite difficult, indeed, to offer any detailed information other than this fact, and

concern themselves with the status of the bony walls of sinuses are apt to be more characteristic and, therefore, more specific. For example, visible expansion of a sinus is virtually pathognomonic of neoplasm,

and if observed in the absence of visible erosive changes in bone the offending neoplasm is apt to be benign rather than malignant. The positive identification of fracture associated with sinus clouding of

fenestration of the maxillary antra was the most commonly employed surgical procedure. In most instances the surgical procedure did not include all of the individual sinuses considered abnormal by the roent-

TABLE XI.—SIGNIFICANCE OF ROENTGEN SIGNS OF SINUS DISEASE
IV. "Expansion (Neoplasm)"

Operative Findings (11 Sinuses)	Ethmoid	Maxillary		Sphenoid	Total
	R (1)	R (7)	L (2)	(1)	
Soft Tissue					
Neoplasm, benign		2			2
Neoplasm, malignant	1	5	2	1	9
Bone					
No statement		2	1		3
Erosion (benign neoplasm)		2			2
Malignant invasion	1	3	1	1	6

fers reasonable grounds for assuming that the clouding is produced by hemorrhage into the sinus. Bone erosion may be produced by invading neoplasm or spreading osteomyelitis. Developmental anomalies are reported most commonly in the case of the frontal cells where congenital absence may lead to erroneous clinical diagnosis because of faulty transillumination with visible light.

The actual accuracy of roentgen findings as compared with underlying disease can be determined only in the light of operative and pathological findings. As was to be expected, only a fraction of the patient group under consideration was ultimately subjected to surgical treatment, a total of 133 individuals. One patient who was operated upon on the basis of positive physical findings in the absence of roentgenologic confirmation is not included, leaving the observations obtained in the 132 cases which were operated upon for comparison with pre-operative roentgen diagnosis. In Table VII the individual sinus cavities explored are listed, indicating the frequency with which various combinations of cells were opened. As might have been expected, simple puncture and

genologist. Table VIII deals with the actual operative findings obtained as the result of exploration of 163 individual chambers previously reported by the roentgenologist to show "clouding." The operative findings are subdivided into those which deal with soft tissues within the cells, as well as abnormalities of bony walls about the sinuses in cases in which such information was available. The non-specificity of this descriptive term used by the roentgenologist is well reflected in this table, although it will be observed that the presence of pus with or without associated thickening of the mucous membrane is responsible for the finding of "clouding" in the majority of the sinuses explored. In explanation of the discovery of neoplasm in the left ethmoid area in five instances, it must be recalled that neoplasms of the nose or orbit may readily invade ethmoid cells. In six instances sclerosis or osteitis discovered by the surgeon was not recognized radiographically and in three instances previously unrecognized osteomyelitis was encountered. In the five examples of malignant invasion of bone described by the surgeon, four concerned the ethmoid cell walls, obviously

for the roentgenologist a difficult site in which to recognize bone destruction.

"Clouding, with bone destruction," reported in 13 sinuses among the group operated upon, represented invasion by malignant tumor in six instances and osteomyelitis in the same number. All of the latter involved frontal sinuses, which is in keeping with the common site of this condition in relation to sinus disease. The neoplasms were found to be far less selective in the matter of location (Table IX).

Analysis of roentgen evidences of thickened mucous membrane lining in the light of operative proof (Table X) shows that the most frequent cause of this change is inflammatory disease. Only one malignant neoplasm appears in this group. Among the bone changes found at operation, it is interesting to note that there were again three occasions when roentgenology failed to recognize osteitis and osteomyelitis. It is true that these changes occurred in areas difficult to demonstrate roentgenographically.

Roentgenologists consider that expansion of a sinus, associated with clouding, is a characteristic sign of neoplasm. Observations recorded in Table XI, although again based on the findings of few instances, justify continued faith in this diagnostic sign. In all these cases either benign or malignant neoplasm was found, and in the majority of them associated bone changes were described.

The frequency with which other radiographic findings were subjected to proof is scarcely great enough to warrant tabulation. Two frontal sinuses reported as showing roentgen signs of clouding with sclerosis were found at operation to show changes characteristic of chronic suppurative sinusitis. This condition was found in two additional sinuses that had been reported as polypoid hyperplasia of the mucosa upon roentgenologic examination. In one instance a reported solitary polyp was confirmed at operation, and removed.

This review of actual experiences with the radiographic approach to the diagnosis of paranasal sinus disease offers con-

vincing proof that such methods are reliable if the limitations of the procedure are clearly appreciated. Apparently this diagnostic measure is not necessary for the recognition of the existence of sinus disease. It does, however, afford a good means of determining the extent of disease in the paranasal sinuses. Involvement of solitary or multiple sinuses can be recognized and the pattern of involvement can be determined with reasonable accuracy. Minimal changes due to disease processes, occurring particularly in the ethmoid and sphenoid cells, may be overlooked because these structures are disadvantageously situated for perfect visualization under some circumstances. Bone destruction may pass unrecognized in these areas even in first quality roentgenograms. Accurate interpretation of sinus roentgenograms is a painstaking, even difficult, task, although the pathologic signs characteristic of disease are relatively few.

DISCUSSION

LEON J. MENVILLE, M.D. (New Orleans, La.): The splendid contribution that we have just heard by Dr. Johnson has indeed been one of great importance. He has been most thorough in his presentation and because of that reason has left but little for me to say.

We all appreciate the importance of the roentgen ray in the diagnosis of paranasal diseases. He has shown us the various conditions which affect their structures and how they may be diagnosed by means of the roentgen ray. He has also demonstrated most clearly that if the roentgen ray is to be of value in the diagnosis of paranasal sinuses, it is important for the roentgenologist to acquire a knowledge of the anatomy and physiology of these structures and also a clear understanding of the pathology of the numerous conditions which affect the paranasal sinuses. In this manner the roentgenologist will become an efficient consultant, when he can intelligently discuss with the referring physician the result of his examination,

and thus keep the roentgen ray in the hands of the roentgenologist.

It is highly desirable for the roentgenologist, in studying diseases of the paranasal sinuses, to attempt, whenever possible, to procure some of the clinical data regarding the examination of the referring physician, and his provisional diagnosis. With this knowledge the roentgenologist functions in the capacity of a physician and is the one to determine how the examination is to be made. Since he is the one who assumes the responsibility of the x-ray examination, he should be the one to decide the technical factors employed.

We all appreciate the fact, of course, that a cloudy sinus will most often mean fluid or probably some thickening of the mucous membrane. However, we know that there are other conditions which will produce cloudy sinuses and I have in mind tumors of the paranasal sinuses. While it is true, as Dr. Johnson has so well presented, that they are not numerous, many of them grow so slowly that when they are discovered clinically they have progressed very markedly, and while it is to be appreciated that we have not as yet been able to place a microscope at the end of an x-ray tube to study the cellular make-up of tumors, we have been able, in

certain instances, to diagnose types of tumors in the human body as correctly with the roentgen ray as by the tissue microscope.

In regard to the frequency of these tumors of the paranasal sinuses, not very long ago Dr. Geschickter, of the Surgical-Pathological Laboratory of Johns Hopkins University, reported in the *American Journal of Cancer*, a series of 211 such cases, in which 16 were benign epithelial tumors; 130 were malignant epithelial tumors; 37 were benign connective tissue tumors, and 16 were sarcoma, so that we know that these tumors do exist and we should be on the alert and try to detect them as early as possible.

While the x-ray is perhaps not as effective in the early recognition of tumors of the paranasal sinuses as it is in tumors in other parts of the body, I would like to emphasize the importance of considering the possibility of their existence more often and of our being on the lookout for them.

In this regard we will keep roentgenology on a high plane where we know that the roentgen ray will become as indispensable to the otolaryngologist as the stethoscope is to the internist and the scalpel to the surgeon.

THE TREATMENT OF ACUTE AND CHRONIC INFLAMMATORY CONDITIONS BY FRACTIONAL DOSES OF X-RAY¹

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THE purpose of this paper is to suggest that in the x-ray treatment of acute infections considerably less radiation may be effective than is generally supposed; that small fractional doses daily or twice daily may be more effective than a single larger dose, and that exacerbations which not infrequently do occur following larger doses may be avoided by dividing the initial dose.

The use of x-radiation in the treatment of infections has been known and advocated for at least ten years. A number of papers by well-known authorities have appeared on the subject. The rationale of treatment and the mode of action of the x-rays have been fairly well established and need not be repeated in detail here.

We may state briefly that following x-ray treatment there is a systemic reaction tending to increase the bacteriolytic and bacteriophagic powers of the circulating blood (1). This reaction may be either in the nature of a general immunization or, more probably, a setting free of the products of the destruction of leukocytes at a site of radiation which may be distant from the lesion. These products are then carried through the blood to the inflammatory focus and there take effect. What takes place when a focus of infection is radiated locally has been described by Desjardins (2), Wintz (3), Manges (4), and many others.

In acute pyogenic infections the infiltration of the leukocytes is the most important factor. Leukocytes are more susceptible to radiation and are the most easily broken down, thereby setting free protective antibodies more quickly than they would become available through natural inflammatory processes. Desjardins (5) states that

the rate of response of the leukocytes to radiation parallels the clinical response. The end-result is a relative alkalinization of the tissues. Local blood supply is increased and the increased permeability of the cell wall favors osmotic exchange. But, as Dyes (6) points out, an increased destruction of leukocytes swamps the tissues with albumen bodies (leucines), causing temporarily at least a relative acidosis with the accumulation of more toxins and decomposition products than can be handled; therefore, resistance to the original infection may be lowered and its exacerbation or spread may be favored, or, as Desjardins (7) puts it, a reactive inflammation is superimposed on the original infection.

The optimum therapeutic dose obviously would be that amount of radiation which would destroy sufficient leukocytes to produce the maximum bacteriolytic and bacteriophagic action at the site of the infection without overloading the tissues with toxins, causing too rapid a breakdown of the suppurative process, or otherwise producing an exacerbation or spreading of the original infection. The optimum spacing of this dose would be that which would permit full utilization of the antibodies produced, without the accumulation of an excess. This optimum therapeutic dose is not a constant, but varies with the stage of the inflammatory process, the degree of leukocytic infiltration, the site and extent of the lesion, and the patient's resistive powers.

Treatment of each case must be individualized. In general, the more acute the inflammation the smaller should be the dose (8), and the closer should be the spacing. It has been stated that if a larger than necessary dose (over 200 r) is given, the favorable result is delayed for some "unknown" reason, but no harm is done (9). This may or may not hold for chronic

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

inflammatory conditions, but it certainly is not true for acute pyogenic infections. A maximum dose, as previously stated, not only may fail to give favorable results, but, by superimposing the reaction due to the x-ray upon that of the original infection, may actually lead to an exacerbation or spread of the infective process. During the suppurative stage, too precipitate a breaking down is dangerous (10). The result, if the infection is superficial, may be relieved by prompt and adequate surgical drainage, but if it is a pelvic or other deep-seated infection lack of adequate drainage may cause serious complications and possibly death.

Even in sub-acute lesions an exacerbation may follow a comparatively small dose of x-ray. For example, x-ray therapy is frequently used for the treatment of boils and carbuncles: 150 r is the usual dose. A young woman 30 years of age presented, with a pustule on her cheek opposite the left lower second molar. It measured about seven millimeters in diameter. She said she had had it for four or five days. It was well circumscribed, not particularly tender, and showed no signs of coming to a head. Her physician advised x-ray treatment and she was given 150 r over the lesion. Twenty-four hours later the entire side of her face was swollen and the cervical glands on that side were enlarged and tender. The condition ultimately subsided with the application of ice and no further x-ray. During the interval her physician and family were considerably alarmed.

Such exacerbations whereby an apparently indolent lesion is suddenly activated following x-ray treatment are well known to dermatologists. They occur frequently in neurology where x-ray is used for the relief of pain in the neuralgias, sciatica, or over the spinal nerve roots. In asthma such reactions may be extremely dangerous. It should be recognized that similar exacerbations do occur following the x-ray treatment of infections even in doses as small as 150 r.

Our experience leads us to believe that

such reactions can be eliminated by dividing the initial dose into fractions. In acute conditions we use 20 r daily or twice daily; in less acute conditions, 50 r daily to a total not exceeding 250 r. For example, a man of 60 years entered a local community hospital with an acute cellulitis of the face and cheek following infection of the upper lip. Sulphanilamide was tried but failed to give relief. His condition was considered urgent. There was no x-ray therapy equipment in the hospital. A self-rectified radiographic unit was calibrated, using a 1 mm. aluminum filter. He was given 20 r twice daily for two days, then once daily for two more. He began to show improvement on the second day and was discharged well on the seventh day. He had no unpleasant reactions.

A diabetic male of 74 years was referred with furunculosis of the nose. He was given 75 r on each of two consecutive days. Almost immediately following the second treatment, swelling and pain markedly increased. Ultimately the process subsided without recurrence. We believe that if we had divided the initial dose we could have avoided the unpleasant reaction. Williams and Bryan (11) have reported the treatment of 170 cases of acute coryza, using daily doses of 20 r four times: 12 per cent were symptom-free in 24 hours, 56 per cent in 48 hours, and 19 per cent in 72 hours. In cases in which we have used x-ray, our results have paralleled theirs.

X-ray, however, has no prophylactic value against recurrence (12). Because of dangers inherent in the repeated use of x-ray in the treatment of recurrent types of infection, we have, therefore, preferred to use ultra-violet and infra-red or short wave diathermy for the treatment of coryza (13). Daniel (14) recommends fractional doses of from 20 to 40 r every two or three days for the treatment of acute inflammatory conditions of the upper respiratory tract, and from 80 to 100 r in chronic cases. In acute sinusitis, particularly of the antrum, we have used 20 r daily or twice daily, not exceeding a total of 400 r with, on the whole, satisfactory results and no

exacerbations. Most rhinologists do not like to open an acute antrum under three weeks. If results are to be obtained by x-ray, they will be evident in less than one-third of that time. We have had no opportunity to treat acute mastoids, but would like to call attention to the work of Rathbone (15), Lucinian (16), and others.

Many infections respond to as small a single dose as 50 r. Furunculosis of the ear, for example, has shown relief from pain the following day, with subsequent resolution without symptoms. In cellulitis, with painful swelling following the difficult extraction of teeth, particularly third molars, the pain is relieved promptly with this dose and the swelling usually subsides in from 24 to 48 hours, which is considerably quicker than can be expected from the use of conventional methods.

On the other hand, we have seen marked exacerbation with distressing symptoms following an initial dose of 50 r in at least two cases of epidermophytosis.

With the exception of sore throats, we have had comparatively little experience with streptococcus infections. Since the infiltration of leukocytes at the site of streptococcus infections is not a predominant factor, it would appear that we are here more dependent on the anti-infective properties of the circulating blood. Therefore, radiation of the lymphatic tissues (spleen, lymph nodes, etc.) in fractional doses might reasonably be expected to be effective as an adjuvant to local radiation.

We have said comparatively little about chronic infections. At present we are using 50 r two or three times a week, with voltage and filtration depending upon the size of the patient and the depth of the lesion. We do not exceed 400 r per series. If necessary, we may give a second or third series at intervals of two or three weeks: we do not give more. Immediate response in chronic infections is not to be expected (17), but if favorable results are not obtained in a reasonable time (*vide supra*), there is nothing to be gained by giving larger doses or prolonging the series. It is

common experience that tissues which have been subjected to too intense or too protracted a series of x-ray or radium treatments are much less resistant to infection. Khreninger (18), by experiments with mice, has shown that sensitivity to infection is proportional to the amount of radiation which the animal has received. Furthermore, the danger of the cumulative effect from repeated small doses should not be lost sight of.

Wintz (19) also mentions the so-called radiofrequency short waves as having possibilities in the treatment of infections. While much that has been written about short waves will have to be discounted, we believe that they have a definite place in radiology. They will apparently accomplish in infections—perhaps in a longer time and with more treatments—fully as much as x-ray, and without the dangers inherent in repeated x-ray exposures. We should prefer short waves for chronic and recurrent infections.

At this point we desire to state most emphatically that the use of the so-called ultra-short waves, meaning thereby the radiofrequency waves of six meters wave length or less, is just as much a part of radiology as x-ray or radium. Their use should not be left in the hands of physiotherapists who, however well trained they may be in baking, massage, corrective exercise, and the like, are neither physicists nor radiologists; and unless they have received special training are not competent to administer this form of radiation intelligently. It should be recognized that the misuse or abuse of this form of radiation can do just as much harm to the patient as the misuse or abuse of x-ray or radium.

In conclusion, we submit that acute infections may be adequately, and perhaps better, treated by small fractional doses, using apparatus of low or medium voltage such as is now available in most of our smaller communities. In case of necessity, even a radiographic unit could be used. We do not, however, intimate that any general practitioner who has an x-ray unit is competent to treat infections. Training,

experience, and accurate calibration of apparatus are, of course, essential.

We make no positive claims for the fractional method at this time. The cases we have reported are selected as typical illustrations. Our series is still too small for statistical evaluation.

We believe this method has possibilities and, therefore, submit this preliminary report for the purpose of recording our own experience and in the hope that it may stimulate further observations and possible confirmation by others.

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BIBLIOGRAPHY

- (1) HEIDENHAIN, L., and FRIED, C.: *Klin. Wchnschr.*, 3, 1121, 1122, June 17, 1924.
- (2) DESJARDINS, A. U.: *RADIOLOGY*, 29, 436-445, October, 1937.
- (3) WINTZ, HERMANN: *RADIOLOGY*, 31, 156-161, August, 1938.
- (4) MANGES, W. F.: *Am. Jour. Roentgenol.* and *Rad. Ther.* (ed.), 35, 399, 400, March, 1936.
- (5) DESJARDINS, A. U.: *loc. cit.*, p. 442.
- (6) DYES, OTTO: *Strahlentherapie*, 47, 160-178, 1933.
- (7) DESJARDINS, A. U.: *loc. cit.*, p. 439.
- (8) SOLOMON, I., and GIBERT, P.: *Presse méd.*, 43, 1251-1253, Aug. 7, 1935.
- (9) EARL, D. M.: *Jour. Iowa St. Med. Soc.*, 28, 142, 143, April, 1938.
- (10) WINTZ, HERMANN: *loc. cit.*, p. 158.
- (11) WILLIAMS, A. J., and BRYAN, L.: *RADIOLOGY*, 26, 45, 46, January, 1936.
- (12) SOLOMON, I., and GIBERT, P.: *loc. cit.*
- (13) OSGOOD, H. A.: *Med. Rec.*, 148, 23, July 6, 1938.
- (14) DANIEL, GASTON: *Bull. et mém. Soc. de radiol. méd. de France*, 24, 113-122, January, 1936.
- (15) RATHBONE, R. R.: *Am. Jour. Roentgenol.* and *Rad. Ther.*, 38, 102-108, July, 1937.
- (16) LUCINIAN, J. H.: *Am. Jour. Roentgenol.* and *Rad. Ther.*, 36, 946-953, December, 1936.
- (17) WIESER, W.: *Strahlentherapie*, 58, 646-650, 1937.
- (18) VON KRENTINGER-GUGGENBERGER, J.: *Strahlentherapie*, 48, 103-109, 1933.
- (19) WINTZ, HERMANN: *loc. cit.*, p. 160.

DISCUSSION

R. R. NEWELL, M.D. (San Francisco): I was very much interested in what Dr. Osgood had to say. I have tried to conduct some clinical experiments to find out exactly how useful x-ray may be in inflammatory conditions.

What I want to point out is the extraordinary difficulty of evaluating the results of a clinical experiment in the use of a therapeutic agent when the disease we are

treating is one from which most of the patients get well.

We have tried to escape from the difficulty by running a controlled series—treating every one presented with that diagnosis, but using a lead filter to block off the x-ray in alternate cases. In some of those we have ourselves not known which filter was blocked off with lead and which filter let x-ray through, so that neither the patient, the radiologist nor the referring physician could know which patient was getting the x-ray treatment and which was not.

We tried such a series in boils and gave 100 roentgens to the boil on each of three successive days. A number of such patients were treated. We could find practically no difference in the clinical courses of the cases that got x-ray and those which did not get x-ray. Maybe we didn't watch them closely enough.

We are sufficiently interested so we are continuing the clinical experiment and are now giving the boil 300 roentgens in one sitting instead of 100 roentgens each of three successive days. I have the impression, from watching the cases, that there are some that react quite miraculously to the single moderate dose of x-ray treatment. I won't know until we study the series, having seen which were getting x-rays and which were not, whether those miracles were spontaneous on the part of the patient or could be ascribed to the x-ray.

HERMAN A. OSGOOD, M.D. (closing): I am very grateful to Dr. Bell for bringing out in his discussion¹ the importance of inflammatory reactions in malignant disease, particularly in mentioning the low rate per minute which, I believe, is extremely important.

Of course, it is difficult to evaluate, as has been stated by the second discussant, any method in which most of our patients recover spontaneously. On the other hand, in colds, for example, the average coryza

¹ Not returned for publication.

runs perhaps for five or seven days. If your patients, in the majority, recover in from twenty-four to forty-eight hours, perhaps we have done something to benefit them.

In the treatment of boils, it depends entirely on what stage you are in. If in the first twenty-four to forty-eight hours, you may get resolution by absorption. If at a later stage, you undoubtedly do hasten suppuration. It is my impression (but here again I do not wish to be too definite) that

the larger dose in boils which are about to suppurate does very definitely break them down more rapidly and the surgeon should be available for incision and drainage.

In fluoroscopic work the danger of giving doses which may be large if held over one area is of considerable importance.

I might state in closing that I know of one case in which there was a very marked exacerbation of epidermophytosis from the examination by x-ray incidental to the fitting of a shoe.

THE DENSITY OF THE CENTRAL SHADOW IN THE DIAGNOSIS OF INTRATHORACIC LESIONS¹

By LEO G. RIGLER, M.D., *Minneapolis, Minnesota*

From the Department of Radiology, University of Minnesota

JUST as there are areas in the lungs silent to auscultation, so there are certain portions of the lung-fields relatively invisible to roentgen exploration. The conception that those areas of the lungs and pleura which are superimposed upon by the denser shadows of the heart and other mediastinal structures, the diaphragms and subdiaphragmatic organs, and even by the ribs, are not entirely amenable to roentgen study, has been partially responsible for the use of the stereoscopic, lateral, and oblique projections. To some extent, the introduction of bronchography served to make roentgen observation of certain sections of the lungs more successful. Nevertheless, the possibility that lesions may be present in the lung which are not visible in the roentgenogram, because they are hidden by the central shadow, is always to be considered.

It is significant that in many textbooks on roentgen diagnosis the diagrammatic representations of roentgenograms of the thorax portray the cardiac area as a blank. The inference from such a representation could be that there is no lung behind the heart or that this portion of the lung cannot be examined roentgenographically: obviously the latter is meant. But experienced roentgenologists frequently are able to detect lesions of the lungs or pleura, which manifest themselves within the cardiac shadow, by the observation of changes of density in this shadow. Curiously enough, there is no reference to this point in the various texts on the roentgen diagnosis of intrathoracic lesions. The observation of variations in the density of the central shadow of the thorax, especially of the

relative density of the portions of the cardiac shadow to the right and left of the spine, has been of such assistance to me in the diagnosis of many pleural and pulmonary lesions that the findings are worthy of expatiation. This point is particularly important when anteroposterior or postero-anterior films of the thorax are the only available studies, as is commonly the case in the more acute and severe illnesses necessitating bedside examination.

It should be emphasized that reasonable penetration must be effected in order to bring out variations in the density of the central shadow. If rather soft exposures, such as those generally used for demonstrating minimal pulmonary lesions, particularly early tuberculous infiltrates, are employed, the entire cardiac area does appear as a blank. All the x-rays directed through this area are absorbed by the shadow of the heart itself. Consequently any change in the lung or pleura which would increase the density of the heart will not be recorded. In the type of case to which the signs to be described below are applicable, overexposure is not harmful as the lesions under investigation are generally gross. At the same time the overexposed roentgenogram permits the demonstration of changes of density which may be of great value in elucidating obscure lesions. We have repeatedly seen cases of pneumonia in which the usual type of film taken in the upright position appeared to be negative. On repetition with the patient supine and a heavy exposure, the evidences of consolidation were obtained.

A study of cross-sections of the thorax indicates that the anteroposterior diameter of the normal heart is approximately equal throughout its extent from right to left except in its most caudal portion.

¹ Presented before the Radiological Society of North America at the Twenty-fourth Annual Meeting at Pittsburgh, Nov. 28-Dec. 2, 1938.

Hence the density of the normal cardiac shadow above the level of the diaphragms should be uniform on both sides of the

the descending aorta may appear to the left of the spine, adding an increment of density at this point. Examination of an-

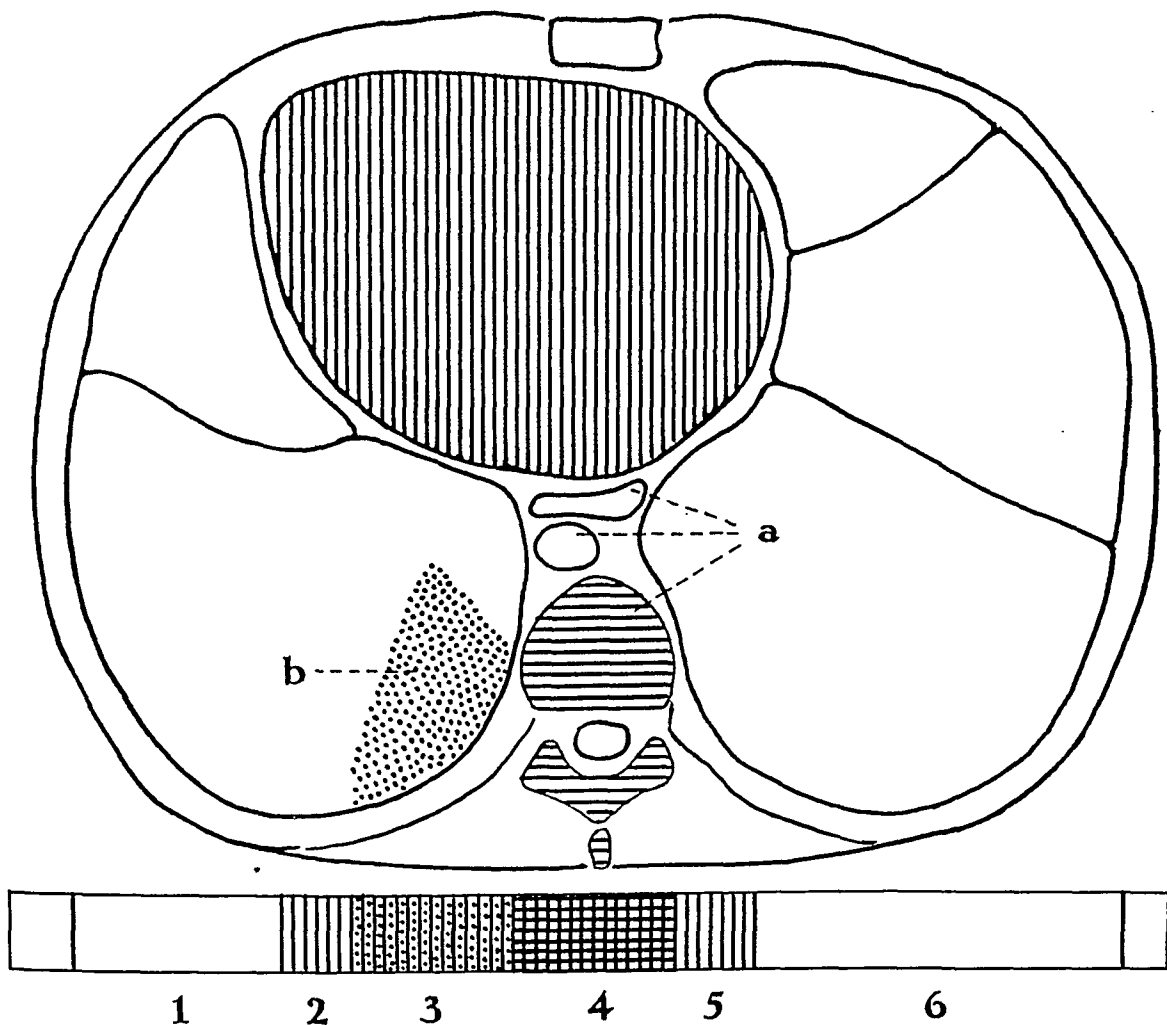


Fig. 1. Schematic representation of cross-section of thorax at the level of the eighth thoracic vertebra in a case of early pneumonia of the left lower lobe. The anteroposterior roentgenogram is shown below. The densities of the cardiac shadow, the spine and mediastinal structures (a), and the consolidation of the lung (b), are all shown by different designs. The projection of these shadows onto the roentgenogram is also recorded by similar designs.

1. Left lung density without superimposition.
2. Normal density of left side of heart.
3. Increased density of left side of heart from superimposition of shadow of consolidation in medial portion of left lower lobe.
4. Increased density of central shadow over spine and large vessels.
5. Normal density of right side of heart (compare with 2).
6. Right lung density without superimposition.

spine. Over the area of the spine the density necessarily is greater because of the superimposed shadow of the sternum, the vertebræ, the large vessels, and other mediastinal structures. In older individuals,

teroposterior or postero-anterior films of the thorax in normals, especially if they are somewhat overexposed, will reveal these uniformities and variations of density of the central shadow. A reference to the dia-

gram illustrated in Figure 1, a cross-section of the thorax at the level of the eighth thoracic vertebra, will indicate graphically the recording of the density of the central thoracic shadow upon the roentgenogram, when an anteroposterior exposure is made. The varying densities are represented on the film by the different types of cross-hatching which correspond to the same design in the structure which is projected upon the roentgenogram. The density of the cardiac shadow is approximately the same to the right of the spine (see 2, Fig. 1) as it is to the left (see 5, Fig. 1), if it is not superimposed upon by any other solid structure. Projection of the vertebrae and other densities in the midline increases the total density of the film at this point (see 4, Fig. 1). Obviously, the density of the base of the heart is somewhat less than that of the more caudal portion. If there is added to the cardiac shadow any additional increment of density such as would occur from a consolidation in the medial portion of the left lower lobe or an effusion in the posterior mediastinal space, an increase in the density of that portion of the cardiac shadow overlying the intrathoracic lesion will result. Such an increment of density is produced in Figure 1 by a triangular area of consolidation of the left lower lobe. The increased density of that portion of the cardiac shadow overlying this area of consolidation is also reproduced on the film (see 3, Fig. 1).

In the early diagnosis of lobar pneumonia, especially of the left lower lobe, a change in density of the central shadow has proved to be a valuable sign. This was casually noted in a paper by Ude (4), but in the voluminous literature on the roentgen diagnosis of pneumonia little attention has been paid to this point. In the earliest stages of the lesion it may, in some cases, be confined to the very medial portion of the lower lobe, so that the cardiac shadow covers the area of consolidation completely. In the case of suspected acute pneumonia, anteroposterior roentgenograms, with the patient supine, are usually made at the bedside. Because of the rela-

tively short focus-film distance the heart shadow is likely to be exaggerated, thus overlapping a much larger area of the lung-field than otherwise. Under such circumstances, the sole evidence of a consolidation may lie in the increased density of the left side of the heart. With this in mind, a careful inspection of the density of the cardiac shadow itself, especially by comparison of the right and left sides, will indicate clearly the presence of the abnormal density in the lower lobe, even if the consolidation does not extend beyond the limits of the cardiac border. The drawings of roentgenograms of the chest shown in Figure 2 illustrate such a case admirably. Figure 2a represents the shadow densities of the normal chest when a heavy exposure is made. In Figure 2b is shown a case of left lower lobar pneumonia. The marked increase in the density of the left side of the heart is shown without any accompanying density in the lung beyond the heart border. A typical roentgenogram of such a case is illustrated in Figure 3. This patient came in for examination less than 24 hours after the onset of the pneumonia. Physical findings over the lungs were practically *nil* at this time. Without the benefit of lateral views a definite diagnosis of left lower lobar pneumonia was readily made from this one roentgenogram. This was abundantly confirmed by the later course of events. We have had a similar experience on many occasions.

The varying densities which may occur with partial consolidation of the left lower lobe are well brought out in Figure 4, an anteroposterior roentgenogram of the thorax in a case of bronchopneumonia superimposed upon bronchiectasis of the left lower lobe. The normal, equal density of the cardiac shadow on both sides of the spine is here illustrated. The increase in density to the left of the spine, due to the descending aorta, is also apparent. The pneumonic consolidation manifests itself as an area of increased density over the apex of the heart and extending into the left lung-field. The contrast in density between the normal heart shadow above and that portion

below which is superimposed upon by the consolidation in the lung is most striking.

It is obvious that lateral views may serve to demonstrate such lesions but these are not always obtainable. The usual routine procedure is to make an anteroposterior view at the bedside. If nothing is observed,

the lateral view may not be undertaken, to avoid further disturbance of the patient. The observation of an increase in the cardiac density may be a sufficient stimulus to prompt a lateral examination, and the diagnosis may thus be confirmed.

While the observation of the increase

Density of the Central Shadow in Lobar Pneumonia

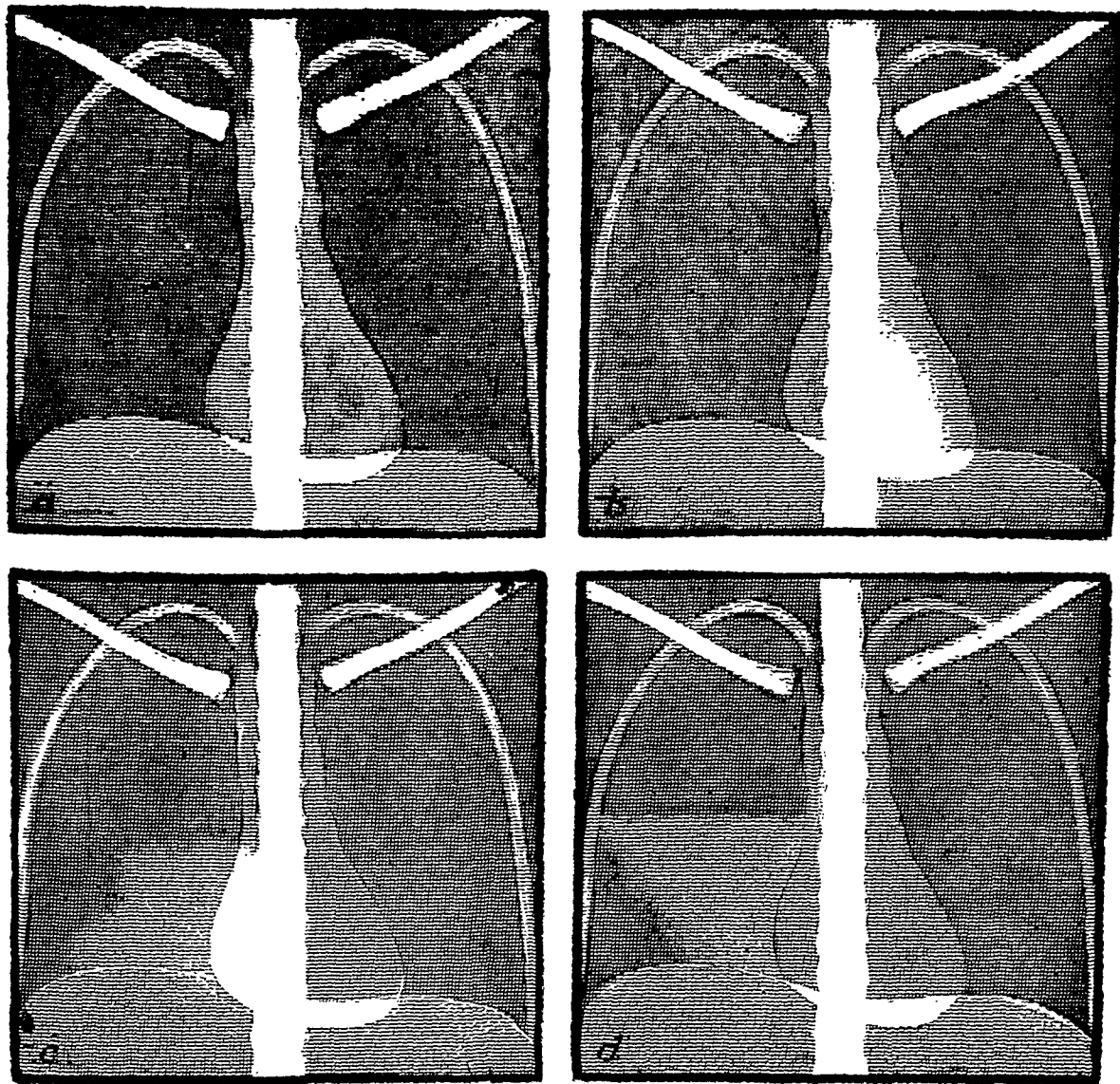


Fig. 2. Drawings of anteroposterior roentgenograms of the thorax. (a) Normal chest showing equal density of central shadow to the left and right of the spine and greater density in the center. (b) Lobar pneumonia, early stage, involving medial portion of left lower lobe only. Note the increased density of the heart to the left of the spine because of the superimposed shadow of the consolidation. (c) Lobar pneumonia, medial portion of right lower lobe. Note the density in the lung-field and the increased density of the central shadow to the right of the spine. (d) Lobar pneumonia, right middle lobe. Note the density of the lung-field without increased density of the central shadow.

in cardiac density applies more frequently to the left lower lobe, it is also occasionally of importance in the very early consolidations of the right lower lobe and the rather rare, localized pneumonia of the anomalous, inferior accessory lobe. Likewise, this sign may be used to aid in the differentiation of pneumonia of the middle from that of the lower lobe on the right side. Not infrequently when a consolidation of the right lung is observed in the anteroposterior roentgenogram, it may be difficult to make this distinction, if satisfactory lateral views are not available. An increase in the density of that portion of the central shadow to the right of the spine usually indicates an involvement of the lower lobe. The absence of such increased density does not, however, exclude pneumonia of the lower lobe, as only its lateral portion may be consolidated. This point is illustrated by the drawings shown in Figures 2c and 2d. The increase in the density of the cardiac shadow to the right of the spine is clearly visible in Figure 2c, and indicates the lower lobar origin of this pneumonia. This conclusion was con-

firmed by lateral examination. In Figure 2d is shown a consolidation of the middle lobe alone, which does not change the density of the central shadow. Obviously, some change may occur because of the small tongue of the middle lobe which extends anterior to the heart, but it is usually insufficient in thickness to produce any marked increase in density.

Other lesions than pneumonia may induce similar changes. Notable among these are the rather infrequent cases of bronchiectasis in which the disease process is almost completely confined to the medial portion of the left lower lobe. In some cases, the entire left lower lobe is involved and, by shrinkage, it assumes a medial position wholly behind the heart. Such cases may escape roentgen observation, although the clinical and physical findings are very obvious. Here again careful observation of the cardiac density may give the clue to the location of the lesion, following which, further examination may give a clear representation of the process. Films made in the anteroposterior projection with the patient supine, preferably with the aid of the



Fig. 3.

Fig. 3. Lobar pneumonia, medial portion left lower lobe, early stage. Anteroposterior roentgenogram, with patient supine. Note the increased density of the left side of the heart in contrast with the shadow to the right of the spine. The consolidation cannot be observed beyond the left border of the heart.

Fig. 4. Bronchopneumonia superimposed upon bronchiectasis, left lower lobe. Note the equal density of the central shadow to the right and left of the spine except for the inferior lateral portion of the heart where the consolidation increases the density to a marked extent.



Fig. 4.

Potter-Bucky diaphragm and considerable overexposure, will permit penetration through the cardiac shadow and reveal the findings perfectly.

Massive atelectasis of the left lower lobe from other causes may likewise give similar findings to those described above. In this instance, the elevation of the diaphragm and the displacement of the mediastinum indicate the nature of the process, but careful attention to the density of the cardiac shadow will serve to determine the location of the collapsed lobe.

Collections of fluid in the mediastinal portion of the pleural space, whether free or encapsulated, will also increase the cardiac density. If the usual postero-anterior roentgenograms alone are available, this change in density of the central shadow may be the only sign of fluid in the pleural cavity. This was pointed out as related to encapsulated mediastinal empyema in a previous publication (2), and has also been noted again by Snure (3). In certain cases of free pleural effusion, as described in another paper (1), the fluid tends to collect in the mediastinal portion of the pleural

space, giving a similar increase in the cardiac density. Such a case is illustrated in Figure 5, in which a free pleural effusion on the left side has extended into the mediastinal pleural space to increase the density of the left side of the heart. In Figure 6 is shown a similar case with fluid and atelectasis on the right side. The marked increase in density of the right portion of the central shadow is demonstrated by the contrast with the opposite side.

It should be apparent that any type of consolidating process in the medial portion of the lower lobes or any mass in the inferior mediastinum will produce, to a more or less degree, the findings described above. Tumor or abscess of the lung, tumor or other glandular enlargement in the mediastinum, aneurysm of the descending aorta, massive dilatation of the esophagus, and paravertebral abscess must be included in this category.

Abnormalities in the density of the cardiac shadow may also be due to intrinsic disease of the heart or pericardium itself. It is at once evident that pericardial effusion, while increasing the anteroposterior

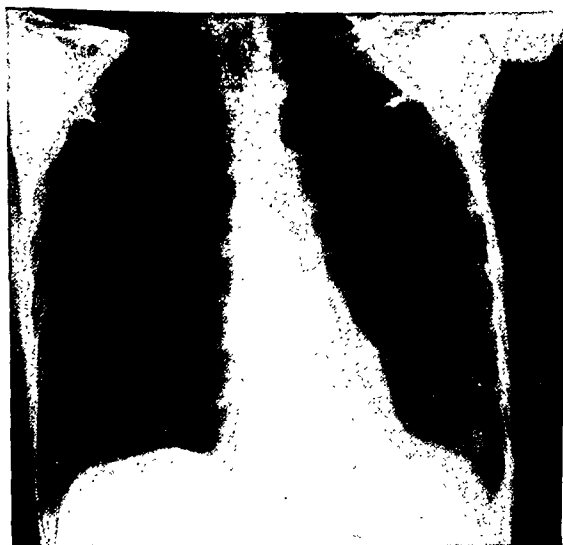


Fig. 5.

Fig. 5. Pleural effusion, left side, with extension behind the heart into mediastinal pleural space. Note the striking increase in density to the left of the spine due to the fluid behind the heart. Diffuse density over the lower left lung-field is due to a thin layer of fluid in the peripheral pleural cavity.

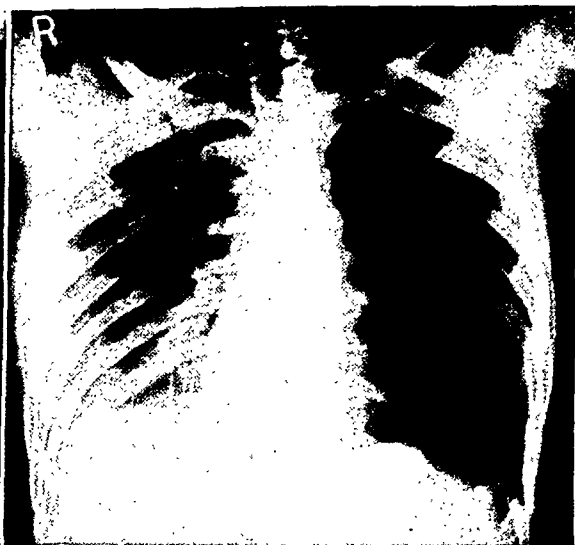


Fig. 6.

Fig. 6. Pleural effusion, right side, with extension into right mediastinal pleural space. The contrast between the increased density of the heart to the right of the spine compared to that on the left is marked. Note the other evidences of effusion, and the signs of atelectasis and pleural adhesions as well.

diameter of the heart, and thus its density, will ordinarily produce such a uniform change that there will be no relative discrepancy in the shadow of the two sides of the heart. In rare cases, encapsulated, purulent pericardial effusion may cause a variation in the density of the cardiac shadow, but this is usually evident from the change in the contour of the shadow. Enlargement of the left ventricle does not appear to disturb this relative density, probably because the heart is rotated sufficiently to compensate for the increased anteroposterior thickness on the left side. The same is true of enlargements of the right ventricle and right atrium. In the case of the left atrium, however, enlargement may produce changes in the density of the various portions of the heart. The left atrium being posterior and centrally placed, its shadow is normally lost within that of the spine and mediastinal structures. When greatly enlarged, however, it will project to some extent to both sides of the central shadow and thus increase the density of that portion of the heart which is abnormally overlapped. The so-called "double shadow," observed over the right side of the heart in cases of massive enlargement of the left atrium, is, in fact, caused by the increased density of the cardiac shadow in its superior portion where both left and right atria overlap, as compared to the lesser density of the right atrium alone, as its shadow comes down to the diaphragm.

SUMMARY

The observation of the degree of cardiac density, particularly the relative density of the right and left sides of the heart, in films of the thorax, is an important aid in the diagnosis of lesions of the lungs and pleura. Increase in the density of the left side of the heart may be the earliest x-ray sign of lobar pneumonia of the left lower lobe. Increase in density on the right side may be used to differentiate lower lobe consolidations from those of the middle lobe on the right side. Other abnormalities such as localized bronchiectasis, atelecta-

sis, lung abscess, tumor, mediastinal pleural effusion, mediastinal tumors, and other masses may also manifest themselves in this way.

The density of the central shadow should always be considered when examining roentgenograms of the thorax.

BIBLIOGRAPHY

- (1) RIGLER, LEO G.: Atypical Distribution of Pleural Effusions. *RADIOLOGY*, 26, 543-550, May, 1936.
- (2) SAGEL, J., and RIGLER, LEO G.: Mediastinal Pleural Effusions: Roentgenologic Study. *Am. Jour. Roentgenol. and Rad. Ther.*, 24, 225-233, September, 1930.
- (3) SNURE, HENRY: Mediastinal Pleurisy: Case Reports and X-ray Diagnosis. *RADIOLOGY*, 18, 1028-1032, May, 1932.
- (4) UDE, W. H.: Roentgenologic Studies in Early Lobar Pneumonia. *Am. Jour. Roentgenol. and Rad. Ther.*, 26, 691-695, November, 1931.

DISCUSSION

WALTER H. UDE, M.D. (Minneapolis, Minn.): It is indeed a privilege to open the discussion of this very interesting presentation.

Dr. Rigler has called to your attention the characteristic appearance of pathologic processes in the retrocardiac portions of the thoracic cavity. He has especially emphasized the changes in the density of the cardiac shadow which may be produced by pneumonic consolidations in the posterior medial portions of the lungs.

In my publication, in 1931, entitled "Roentgenologic Studies in Early Lobar Pneumonia," I called attention to the demonstration of retrocardiac consolidations by showing that they represented increased densities in the anteroposterior view, and that their presence and character could be further established by the lateral view. That the postero-anterior view is more advantageous than the anteroposterior is apparent, since the portions of the lung to be studied are thereby brought nearer the film. Since this is the usual type of film to be made at the bedside of the pneumonia patient, the detection of such consolidations is thereby facilitated. The early lobar pneumonic triangular shadow may be demonstrated as well behind the narrow portion of the heart which projects

to the right of the spine, as behind the broader left lateral portion of the heart. For all practical purposes, the relative densities of these two portions of the cardiac shadow are the same, so that any increase in the density of one side as compared with the other should be noted and its significance determined.

If the triangular shadow of early lobar pneumonia is viewed along its long axis, it will become immediately apparent that the triangle is due to a cone-shaped consolidated segment of the lung, since in this view it presents a rounded or ovoid density. When this cone-shaped consolidation involves the upper medial portions of the lower lobes, the anteroposterior view presents a rounded homogeneous density overlying and projecting well beyond the hilum of the involved lung. This appearance formerly was interpreted as being due to "hilum" or "central" lobar pneumonia. The lateral film clearly shows that only the apical portion of these consolidated areas approaches the hilum, while the broad base which furnishes the rounded density is at the posterior periphery of the upper portion of the lower lobe. I, therefore, may repeat my previous recommendation that the term "hilum" or "central" pneumonia should be discarded.

Bronchopneumonic consolidations in the retrocardiac areas may likewise be identified by an analysis of the density of the cardiac shadow. Differential diagnosis from the more chronic basal inflammatory processes is, however, more difficult, since the bronchopneumonic shadows are not homogeneous in density, and are irregular in distribution.

R. R. NEWELL, M.D. (San Francisco): I am very enthusiastic about what Dr. Rigler has pointed out in regard to discovering lesions in the lungs which are hidden by the heavy shadow of the heart, and the same thing applies to the lower posterior corner where it is hidden by the heavy diaphragm.

We have made a practice for many years of studying fluoroscopically every patient

we could before we make films of the chest. You can usually, if you are suspicious of these conditions, pick them up in the lateral view.

One would say also that in bedside work it is usually possible to get a lateral view of some sort, even though the patient is very thick. I do agree that it is not so very important in which direction the x-ray goes through the chest. When you take an anterior view of the chest, you ordinarily set the tube down at a lower level so as to bring the apices above the shadows of the clavicles. If you project the line through to the front [illustrating on a fellow-member], then you see that in order to follow the same line in reverse direction, as when the film is placed behind the patient, then the tube must be way up above the patient's head. But if we use the same line of projection, it makes little difference whether it goes through the patient front to back or back to front.

There is another thing I would like to say: That the heart only interferes with the visualization of what there is in the lung behind it as a filter would interfere. That is, by increasing the necessary exposure, the heart does not really hide the shadow; it only makes the necessary exposure higher. But the heart also scatters x-rays, so that if you are trying to get views of what is behind the heart you ought to use a Bucky diaphragm.

One more word: I have long thought that an anterior and a lateral might often be better than a stereo-anterior if we are only going to use two films. It looks now as though in many instances we are going to have to use three films and a fluoroscopic examination, too.

The conclusion, of course, is that efficiency is not the same thing for a doctor as it is for an engineer. For a doctor, efficiency consists in working as hard as possible over every patient so that by wasting a lot of energy he may be sure he doesn't overlook something in one particular patient.

LEO G. RIGLER, M.D. (*closing*): I

think we are in thorough agreement except for the fact that, in taking films at the bedside, our experience has been at least that it is difficult to get the laterals—not that the technic is difficult but that their taking means rolling the patient on one side, getting his hands and arms up above his head; he has to hold his breath for a longer period of time unless you happen to be in the fortunate position of having a very powerful bedside unit. It is pretty difficult to get these in a very short period of time, so we have tried to avoid that purely, let us say, for the sake of co-operation with the clinician in acutely ill patients so as not to alarm them.

In our hospital I think the clinicians are much more dependent upon roentgen examination in pneumonia cases than they are on their own findings. We have finally convinced them that we disturb the patient infinitely less than they do, and we get much more information. We are in general agreement on that. At the same time, we

are anxious not to change the situation as far as disturbance of the patient is concerned.

I agree thoroughly with Dr. Newell that I would rather have a single postero-anterior or anteroposterior view and a lateral than a stereoscopic set, in the average patient who comes to you ambulant.

The focus-film distance at the bedside is distinctly less than what one would ordinarily use in routine examination. The result, particularly when you make anteroposterior films, is that the size of the heart is more exaggerated than it would be normally in most cases. The hearts look fairly large because of the short focus-film distance and the anteroposterior position. As a result, larger areas of the lung are overlapped and I am sure Dr. Newell is quite right in saying that the heart thereby increases the exposure necessary through that area. But we can take advantage of that increase in exposure by the difference in density of the two sides which results.

SOME EXPERIENCES, EXPERIMENTAL AND CLINICAL, WITH DIRECT IRRADIATION
OF NEUROLOGICAL TUMORS DURING OPERATION WITH
LOW VOLTAGE RADIATION¹

By JOHN RUSSELL CARTY, M.D., and BRONSON S. RAY, M.D., *New York City*

SURGERY for the treatment and cure of tumors of the brain and spinal cord has not reached a point where more than limited satisfaction can be obtained from a study of end-results. Relatively benign and encapsulated tumors such as meningiomas can be totally removed and some types of gliomas can be similarly attacked. More than 25 per cent of the gliomas are likely to recur even after an apparently total excision.

Because of many variable factors there has been little unanimity of opinion regarding the absolute value of x-ray therapy in the treatment of neurological tumors. At a meeting of the Association for Research in Neurology and Mental Deficiency, in 1935, the conclusions of those who took part in a discussion as to the value of x-ray therapy are as follows (we quote Elsberg):

1. Radiation has an undoubted effect upon many tumors of the brain.

2. The degree of effect is not known because there have been too few careful histological studies of the tumor tissue before and after treatment.

3. There is little exact knowledge of the relation of the amount of radiation used to the results obtained.

4. Profound changes in tumor cells may be produced by roentgen therapy.

5. In a large proportion of the patients the roentgen-ray dose was inadequate.

6. With methods hitherto used adequate doses of roentgen rays cannot be given because of the danger of injury to the soft and bony tissues of the head.

With these considerations undoubtedly in mind, Dr. Cushing in 1930-1931 planted

radium bombs consisting of radon seeds and sponge rubber dams in the excision cavities of the highly malignant glioblastoma multiforme. After a few days the flap was re-elevated and the bomb removed. After a short experience with this procedure he abandoned it. Others have used the same procedure without satisfactory results.

In 1937, Sachs, Moore, and Furlow, also Elsberg, Davidoff, and Dyke, published preliminary reports on the direct roentgen radiation of brain and cord tumors during operation, but little has been heard of this method since. Personal communication with some of those who have used direct irradiation has convinced us that the factor of safety is very small indeed when large doses are employed using radiation of 200 kv.p. This is further substantiated by the detailed reports of Elsberg, Dyke, *et al.* regarding the effect of large doses of 200 kv.p. radiation on the brain and spinal cord of monkeys, read before the International Congress of Radiology in 1937. The destructive effects of the radiation spread far beyond the confines of the primary beam.

From every theoretical consideration, except for the possibility of damage to closely grouped vital surrounding structures, direct irradiation is highly desirable. Bromley says, "Even when for various reasons the effect of the Chaoul beam has been to cause necrosis of tissue, the effect is very strictly localized and the recuperative powers of the immediate adjacent tissues are unaffected." Chaoul, Morison, Mayneord and others have given considerable attention to the physical factors involved. We will not dwell on this aspect except to re-emphasize that there is a rapid falling off in intensity in the superficial layers (1 cm.) and beyond. It is important to re-

¹ Read by Dr. Carty before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

member that this limitation makes surgical removal of as much of the tumor as possible imperative, if results are to be obtained with low voltage irradiation.

We do not propose to enter into a discussion regarding the relative effects, if any, of high voltage *versus* low voltage irradiation on tumors, but merely to detail our preliminary experiences with the hope that they might be of help to others wishing to work along similar lines. They consist of a study of the effects of low voltage irradiation on the normal dog's brain and clinical experiences with 12 patients suffering from brain or cord tumors, with particular reference to any reaction which might be interpreted as the result of damage to normal structures.

A self-rectified, oil-immersed shock-proof unit was mounted upon a mobile platform. The outfit is capable of regulation from 30 to 100 kv.p., and, although heavy, can be readily moved to the operating room. There is a series of detachable cones of various lengths and sizes which are readily sterilized. The oil in the shock-proof head introduces a filtration element equivalent to about 0.5 mm. aluminum. The intensity of radiation is such that a dose of 2,000 r measured in air can be delivered at 20 cm. distance in 20 minutes.

Experimental Data.—Using dogs as experimental animals, we treated the brains of three groups with different dosages of low voltage radiation, namely, 6,000, 12,000, and 18,000 r units, all at 60 kv.p.

Intensity measurements were made in air with a small chamber Victoreen r meter. No filters were used, although there was an inherent oil filtration factor of approximately 0.5 mm. of aluminum.

The essentials of the technic were as follows: During nembutal anesthesia a window about two centimeters in diameter was removed from the right parietal region of a dog's skull. The window was so placed as to overlie the motor cortex, but the dura was not opened because to do so would allow changes in the cortex to result from the irritation of drying, and manipulation. The dura is such a very thin structure in a

dog that it could hardly be a factor in diminishing the effect of radiation on the brain. A tubular cone having an aperture of 12 mm. and allowing a distance of 20 cm. from target to brain was used and directed so that the rays might pass through to the cortex of the opposite side of the brain.

Clinical observations were made during the administration of the radiation and at regular intervals subsequently. Dogs of each of the three groups, representing different dosages, were sacrificed after two weeks, seven weeks, and five months.

We are not yet prepared to make complete reports of the findings or to draw final conclusions, but a few interesting observations have been made. Some of these we shall list, as follows:

1. There were no significant changes in temperature, pulse, or respiration and no convulsions during the irradiation.
2. The wounds in *all* dogs healed satisfactorily.
3. The dogs given 6,000 and 12,000 r units never showed changes in their general health, nor did palsies, reflex changes, nor sensory changes develop.
4. The dogs given 18,000 r units showed immediately a lethargy, anorexia, and sometimes vomiting, which gradually improved until the dogs returned to normal after two weeks. These dogs all developed some degree of contralateral palsies (partial paralysis) of fore and hind legs within from seven to ten days. The degree of palsy usually diminished later. There were no gross sensory changes and no palsies developed on the same side of the body as the irradiation, *i.e.*, on the ipsilateral side.
5. When the dogs were sacrificed, brains of those having had 6,000 and 12,000 r units showed no *gross* changes, *i.e.*, the dura was not adherent to cortex; the cortical vessels, convolutions, and color appeared normal, and coronal sections through

the irradiated area appeared grossly normal.

6. When microscopic studies were made

gliosis. Very slight but unimpressive fibrosis of small vessels in the area was present. Else-

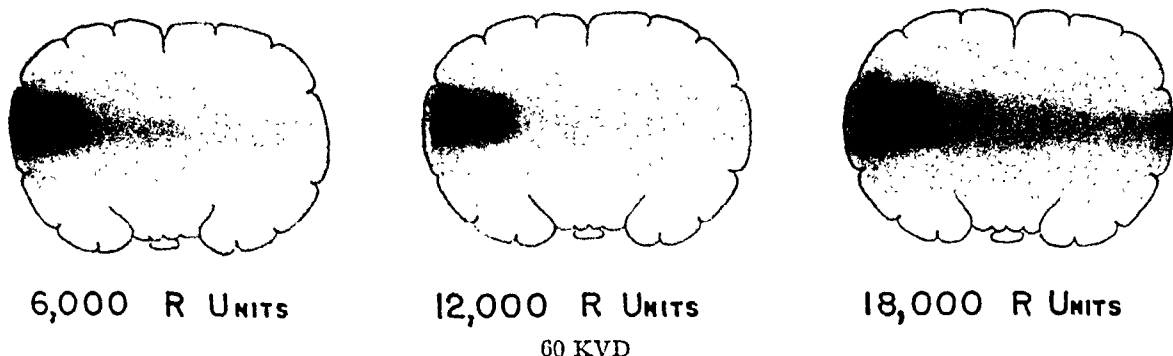


Fig. 1. Biological (isodose) diagram showing effect of low voltage irradiation on a dog's brain. The diagram represents the exact size of a coronal section of a dog's brain which has received 6,000, 12,000 and 18,000 r units, respectively, measured in air at 60 kv.p., without filtration, at 20 cm. distance. Histological sections were cut through the treated area and the number of degenerated ganglion cells were counted. The shading indicates the relative proportion of destroyed cells, the dark areas indicating the greater cellular destruction. Note the comparatively sharp lateral limitation of the beam and the shallowness of the maximum depth effect in the tissue. This represents an ideal condition in cases in which important normal structures are close by. It also indicates the necessity for removal of as much of the tumor as possible before treating.

of complete coronal sections of these brains having had 6,000 and 12,000 r units—

(A) There were found at the end of *two weeks* cells in various stages of degeneration on the right side of the brain and along the course of the direction of the radiation. Away from the line of radiation degenerated cells occurred in diminishing numbers, and on the opposite side of the brain only a few scattered "sickly" looking cells were present.

(B) It was found after *seven weeks* that many of these degenerated cells were being rapidly phagocytosed, there being fewer in evidence. A few degenerated ones were still in evidence; others may have recovered and returned to normal.

(C) There was found after *five months* that in a comparatively superficial, localized, and well demarcated area of the cortex corresponding to the site of irradiation there was a paucity of ganglion cells and a moderate

where in that lobe and in the opposite hemisphere, no changes of any kind could be noticed.

7. The difference between the effects of 6,000 and 12,000 r units appeared to be solely one of numbers of ganglion cells destroyed. The distribution of the damage was the *same*; the numbers of cells damaged for a given field in comparable areas was about twice as great in the brain that had had 12,000 r units.

8. Now when the dogs having had 18,000 units were sacrificed, the dura was locally adherent to the cortex and beneath it there was a small (1 cm.) area of discoloration and softening of the brain. The convolutions of a large part of the right hemisphere were flattened, a condition which was not true of the opposite hemisphere.

9. When microscopic studies were made of coronal sections of these brains (having had 18,000 r units), there was found—

(A) At the end of two weeks, the right side of the brain showed extensive edema, hemorrhagic

infiltration, a well localized area about one centimeter in width and depth in which there was

(B) After seven weeks the localized area of degeneration just described had become frankly ne-

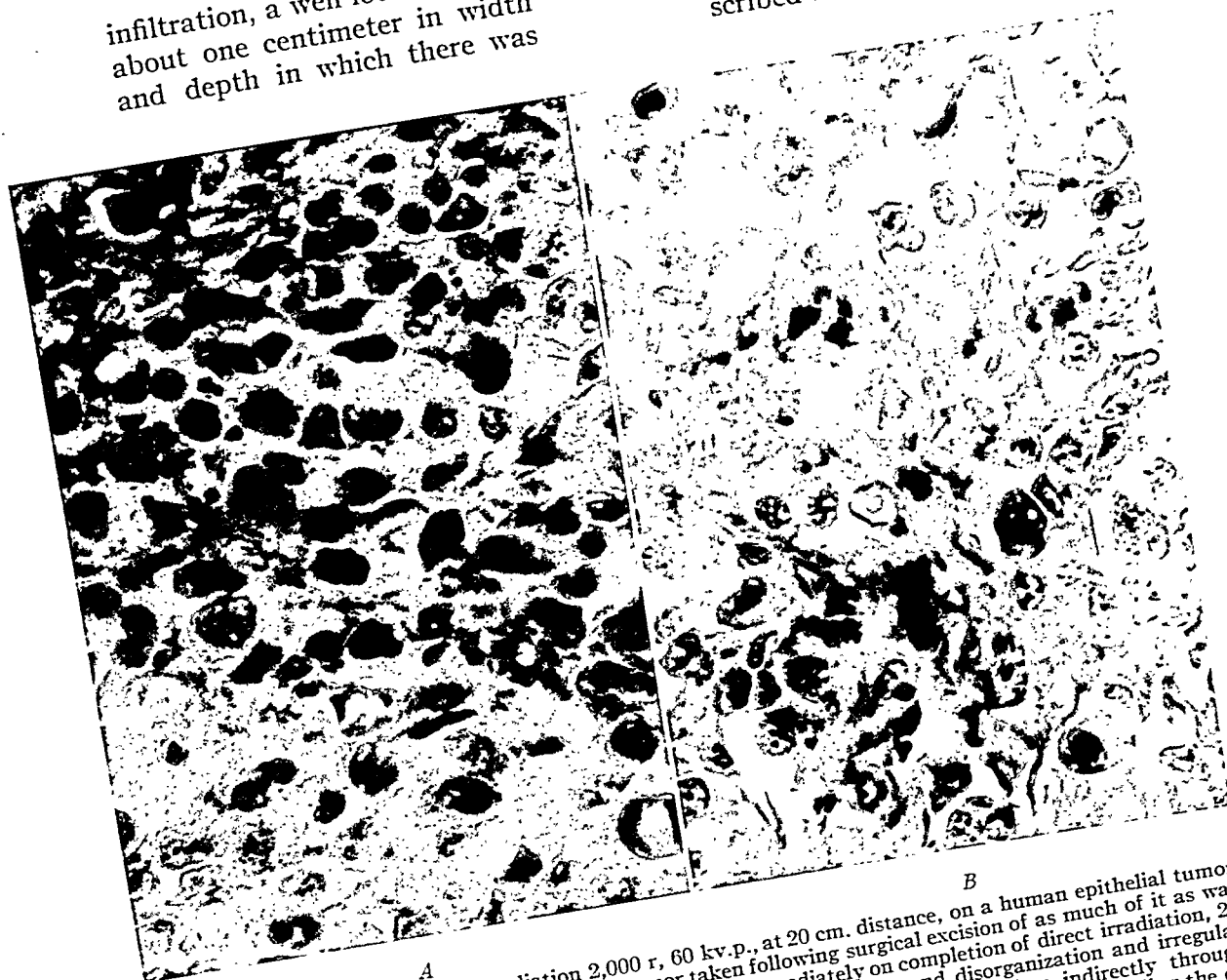


Fig. 2. Effect of low voltage irradiation 2,000 r, 60 kv.p., at 20 cm. distance, on a human epithelial tumor of the central nervous system. (A) Section of tumor taken following surgical excision of as much of it as was possible; (B) Section of tumor from the same region taken immediately on completion of direct irradiation, 20 minutes after the beginning of the treatment. Note cellular destruction and disorganization and irregular stain. This would indicate a direct effect on the tumor cells themselves rather than indirectly through action on the blood supply. More studies such as this should give us valuable information regarding the effect of radiation on tumors.

advanced degeneration with total absence of ganglion cells, and alteration in glial cells and in small blood vessels. Degeneration in cells elsewhere in the lobe was increasingly less evident at a distance from the direct line of the radiation. Throughout the opposite hemisphere there were scattered degenerated ganglion cells, although again they were most numerous in the direct line of the radiation.

crotic and there was beginning encapsulation of the region. Elsewhere the number of degenerated cells was less, many having been already phagocytized.

(C) The studies on these heavily irradiated brains after five months have not been completed.

10. No changes in the corpus callosum or basal ganglia have been detected. One may be allowed a few conclusions from the work thus far. It appears that the dog's brain can stand dosages up to

12,000 r units at low voltage without showing clinical effects or more than minor microscopic changes. Using larger dosage (18,000 r), we have been able to demonstrate that with low voltage the *depth* intensity of the rays is limited, as indicated by cellular changes, and there is comparatively little scattering effect outside the limits of the direction of the beam.

Clinical Experience.—In the past year in the operating room we have treated through the open wound six tumors of the brain and six of or about the cord with low voltage radiation. In every instance the tumors were recognized as incurable: nevertheless, extensive excision was carried out before the radiation was administered. Usually a dosage of 2,000 r units at 60 kv.p. at a distance of 20 cm. was used. A cone suitable for the field was employed and wound edges and adjacent tissues protected with sterilized sheet lead.

In several cases sections were taken from the tumor before and immediately after treating. Very definite degenerative changes were noted in the sections made after—as soon as the radiation was discontinued. Both neurogenic and epithelial tumors showed this effect. To us, this seems interesting and significant. That radiation could, in the short period of 20 minutes, produce profound changes in tumor cells indicates that perhaps the factor of endarteritis is not as important in the effect.

Madeline P., aged 26 years, was operated upon just a year ago for a fairly large glioblastoma multiforme of the left frontal lobe. At a first operation we exposed the tumor and removed half of it; at a second operation, shortly after, a large part of the remainder was excised and the cavity was treated with 2,000 r units at 80 kv.p. at a distance of 20 cm. The time required to administer this dosage was 18 minutes.

Following an uncomplicated recovery she was started on the usual post-operative roentgen therapy. To-day she is an essentially normal individual with no evidence of recurrence.

We have no intention of pointing to this

case as unusual in its recovery period, for not a few cases of glioblastoma multiforme have gone a year or two before giving signs of recurrence, even when much less of the tumor was removed and perhaps no roentgen therapy was given. But she was the first case, and at least we found that the dosage used here was accompanied by no ill effects.

Margaret B., aged 51 years, was operated on for a large glioblastoma of the right posterior parietal region in September, 1937. We excised a fair portion of the tumor, leaving a large decompression. We had not then started to use the direct therapy method, but she was given the usual repeated post-operative series of roentgen therapy. After ten months her symptoms began to recur and she returned, nine weeks ago, with evidence of considerable intracranial pressure and a paralysis of the left arm and leg.

Three days after admission we resected all of the right temporal and occipital lobes and the posterior part of the parietal lobe within which resided the visible tumor. The basal ganglia were left intact. At the end of this procedure 6,000 r units of roentgen therapy, at 60 kv.p., and at an average distance of 24 cm., was directed at the amputated end of the right hemisphere. This therapy required one hour twelve minutes in addition to the three hours necessary to resect the hemisphere, but the patient, who had been under local anesthesia throughout, jokingly asked for a glass of schnapps as we were putting on the dressing.

Microscopic examination of sections from a small block of tumor that had been placed in the path of the radiation during the treatment showed chromotolysis, characterized by indistinct nuclei and increased density of the cytoplasm.

Her first post-operative week was satisfactory in every way—motion began to return to the left side, and there was little reaction. On the eighth day an unexplained fever developed and a paresis of the left side of the face appeared. Since no other cause could be discovered, it was as-

sumed that this was the result of a "delayed" reaction of the radiation. This seemed the more likely when we recalled that several of the cord tumor cases treated with direct radiation developed unexplained fever on the eighth to tenth days, though the fever disappeared within two weeks.

The facial palsy here gradually disappeared, but the fever and a tachycardia persist after eight weeks. Meanwhile, the patient has increased her activity and complains only of "weakness." The wound has healed and the intracranial fluid, which at first contained many cells and caused the decompression to bulge, now has diminished in amount and contains few cells.

We cannot say that the radiation therapy is responsible for the hyperthermia, but we suspect that it is and that the hypothalamus has been affected. Certainly the right motor cortex has not shown evidence of much, if any, damage.

Recapitulating our clinical experience, 11 patients with brain and cord tumors were given 2,000 r units at from 60 to 80 kv.p., and one with 6,000 r units at 60 kv.p. The longest period of observation was one year. Two of the cord tumor cases and one brain case developed unexplained fever, which was temporary except in the case of the patient receiving 6,000 r, where it still persists after two months. A temporary facial palsy developed in this case also. With these exceptions no reactions were noted which could be attributed to brain damage from the radiation. Definite tumor-cell destruction has been noted within 20 minutes after the beginning of irradiation.

CONCLUSIONS

Our experimental and clinical experience with nervous tissue confirms the findings of Bromley and others that the effect of low voltage irradiation is sharply limited to the confines of the primary beam, and that the effect is rather sharply confined to superficial layers. Surgical excision of as much of the tumor as possible is essential if results are to be expected.

We wish to express our deep appreciation to Dr. George Heuer, whose co-operation and interest made this work possible, and also to Dr. N. Chandler Foot for his invaluable help with the pathological sections.

BIBLIOGRAPHY

1. ELSBERG, C. A., DAVIDOFF, L. M., and DYKE, C. G.: The Roentgen Treatment of Tumors of the Brain in the Operating Room by Direct Radiation Through the Operating Wound. *Bull. Neurol. Inst.* New York, 6, 19-32, January, 1937.
2. SACHS, E., MOORE, S., and FURLow, L. T.: Direct Roentgen Radiation of Brain Tumors During Operation. *Ann. Surg.*, 105, 658-661, May, 1937.
3. CHAUL, H.: Die Behandlung bösartiger Geschwülste durch eine der Radiumtherapie angepasste Röntgenbestrahlung. *München. med. Wchnschr.*, 81, 235-239, Feb. 16, 1934.
4. MORISON, WOODBURN, HUGO, D., and MAYNEORD, W. V.: Preliminary Note on Low Voltage X-ray Therapy. *British Med. Jour.*, 2, 783, 784, Oct. 26, 1935.
5. MAYNEORD, W. V.: Distribution of Radiation around Simple Radio-active Sources. *British Jour. Radiol.*, 5, 677-716, September, 1932.
6. BROMLEY, J. F.: Malignancy in the Skin. *British Jour. Radiol.*, 9, 659-670, October, 1936.
7. FINZI, N. S.: Late X-ray and Radium Effects. *British Jour. Radiol.*, 6, 148-157, March, 1933.
8. REINHARD, M. C., and GOODALE, H.: Surface and Depth Intensities for Short Distance Low Voltage Therapy. *RADIOLOGY*, 30, 221-224, February, 1938.

DISCUSSION

SHERWOOD MOORE, M.D. (St. Louis): We have had the privilege of listening to a very valuable and scientific paper. About twenty years ago, at the suggestion of Dr. Vilray P. Blair, I gave what at that time was an immense dose of x-radiation to an incompletely removed metastatic carcinoma of buccal origin involving the glands of the neck. This dose was given through the open wound with subsequent closure. We continued to follow this procedure occasionally until about eight years ago, at which time we applied it to more cases in the neck and extended the application of the maneuver to the axilla in certain cases of breast cancer. Some time later this method was employed in the treatment of cancer of the bladder in conjunction with cystostomy. In May, 1936, this method was used to treat a medulloblastoma through a craniotomy. The experience that we had had in other anatomical regions led us to believe that very large doses of x-

radiation could be applied intracranially. We began with a dose of 6,000 roentgens (measured in air).

In our first cases, chiefly because of shock-proof equipment, we used 200 kv., 1 mm. Cu filter, and a 50 cm. distance. The time necessary for this treatment in what may be said to be the middle of a surgical operation was prohibitive. In consequence, we acquired a shock-proof, low voltage apparatus which allowed the administration of the necessary dosage in the minimum of time. The distance was reduced to the minimum possible. This varies from 10 to 15 cm. and there is no filtration. The object is to have the maximum absorption of ray by the tumor and the minimum amount of absorption in normal structures distal to the tumor. Treatment of tumors through the open wound has been done on 88 cases. Seventeen of these were one type or another of brain tumor, all of them inoperable. As suitable cases have been encountered we have continued this type of treatment of brain tumors but have gone to a lower value than 6,000 roentgens.

At present, no conclusions as to the value of this method of treatment of brain tumors can be drawn. We have yet to observe serious consequences. One child with a partially operable medulloblastoma in the region of the third ventricle received 6,000 roentgens to the remainder of the

tumor. The patient did very well for a while, but there was a recurrence of symptoms. Dr. Leonard T. Furlow re-operated on the patient and was able to enucleate the remainder of this tumor. In his opinion the enucleation was possible because of the radiation effects. He recently said that as far as he could determine, the child was entirely well and that he planned to report this case at some time in the future.

I am a firm believer in direct, low voltage, unfiltered irradiation after surgical exposure in hopeless cases of tumor. I believe we can in this way accomplish great good for otherwise hopeless patients.

JOHN R. CARTY, M.D. (New York): I wish to thank Dr. Moore for his very valuable discussion of this paper.

If low voltage radiation is used, the necessity for radical surgery is greatly increased. It is essentially a combined surgical and radiological procedure. Owing to the relatively few cases that we have treated, we are now in no position to evaluate end-results. When one sees very definite tumor destruction in the short period of twenty minutes there is a challenge, which perhaps it may be possible to meet, that the remaining tumor cells left after operative removal may be destroyed by radiation without serious damage to the normal brain structures.

A FURTHER CONSIDERATION OF THE ROENTGEN-RAY MANIFESTATIONS IN AMEBIC INFECTIONS OF THE LARGE BOWEL¹

By JOSEPH C. BELL, M.D., *Louisville, Kentucky*

INFECTION in man by the pathogenic ameba, *Endameba histolytica*, is widespread, not only in the tropics but also in most other parts of the world. Many persons who harbor this organism show little if any evidence of its presence and these may be classified as supposedly healthy carriers or as ones having very mild symptoms of the infection. Others have definite clinical evidence of the infection and are usually classified as cases of acute or chronic amebic dysentery, depending upon the duration and severity of their symptoms.

All will agree that it is of utmost importance not only to the one infected but to the public in general, as well, for the diseased individuals to be recognized and for suitable therapy to be instituted. The ultimate diagnosis rests on the demonstration of the infecting organism in the bowel content or in material removed from ulcerated areas in the bowel wall during a sigmoidoscopic examination. A possible exception to this, in a few cases, is confirmation of a presumptive diagnosis by response to specific therapy even when the ameba cannot be demonstrated. Any means of diagnosis that will aid in the detection of this disease should be welcomed and made use of by the workers in this field.

Until recently, the roentgen-ray examination of the large bowel of individuals suspected of amebiasis has been given little consideration as a diagnostic aid. We are indebted to Vallarino for first showing that definite variations from normal, readily demonstrable by the roentgen ray, take place in a large percentage of individuals suffering from this disease. He did not observe changes that he considered to

be peculiar to this disease alone, and in themselves diagnostic, but did find some that occurred with sufficient frequency to demand a consideration of amebiasis in the differential diagnosis in cases in which they were found. These observations were published in 1925 (1). In 1928, before the Royal Society of Tropical Medicine and Hygiene in London (2), he presented another communication on this subject. In it he emphasized the close correlation between the clinical, postmortem, and roentgen-ray findings in the cases studied. His conclusions were: "The ultimate diagnosis should be made at the laboratory, and the roentgen findings at present should determine the extent and possibly the severity of the infection, and check up the improvement following treatment." In this same communication he stated as follows: "If, even after repeated examinations of the stools, no amebæ can be found present, but the roentgen-ray findings give evidence of the presence of the characteristic filling defects in the large bowel, it may be advisable to place the patient under anti-amebic treatment, and the clinical course of the disease be checked up by roentgenologic examinations." In a personal communication in March of this [1938] year he again emphasized the importance of the roentgen examination in checking the results of treatment as well as the accuracy of the diagnosis. He stated, as he had done previously, that the cecum is the part of the large bowel most often affected and that abnormalities of the cecum may be taken as a fairly good indication of the existence of amebic colitis.

Weber (4), in 1933, gave a classic description of the changes in the large bowel that may be seen in amebiasis in the central and northern sections of the United States, if I may judge by my own experiences.

During the past four years I have had

¹ Presented before the Section on Radiology on the American Medical Association, in San Francisco, June 13-17, 1938.

the opportunity to study carefully 13 cases in which *Endameba histolytica*, or the cysts of this organism, were demonstrated in the stool, together with two others in which the diagnosis was considered proven by the changes present in the colon and the responses to specific therapy. Seven of these cases were presented before the Southern Medical Association (5) and two others before the American Roentgen Ray Society (6). Three of the most recent cases are included in this communication, together with a discussion of some of the observations made in this study. The number of cases is not large for the disease cannot be said to be common in this locality and these cases have been gleaned entirely from a private hospital and office practice.

Abnormalities Observed in the Examination of the Colon.—In 1933, Weber (4) wrote as follows: "The cecum demands particular attention. It has been the site of maximal roentgenologic change in every instance in which I have offered a diagnosis of amebic ulcerative colitis. Suppression of haustral markings, shortening, and narrowing, sometimes to the extent of almost complete obliteration of the lumen, have been observed uniformly in the cecal segment." He next called attention to the peculiar unimpeded rush of the opaque material from the large bowel into the ileum without delay at the ileocecal valve and without distention of the cecum, and again (3) strongly emphasized this finding in his discussion of my paper presented before the American Roentgen Ray Society.

My observations have been entirely in accord with those of Weber. The cecum has been definitely abnormal in each case in which a diagnosis of subacute or chronic amebic dysentery has been made. The changes have varied from loss of the normal markings, together with slight narrowing of the lumen and some loss of flexibility, to almost complete obliteration of the lumen. In some instances the margins of the cecum have been regular while in others they have been distinctly irregular. The changes have always been quite symmetrical in their distribution. In two instances

the abnormalities have been limited to the cecum but in the others there have been changes in other parts of the large bowel as well.

The peculiar rush of the material from the large bowel into the ileum has been seen in every case studied and has frequently been one of the most striking abnormalities observed. Weber says it is not difficult to distinguish between normal and pathologic escape of material from the large bowel into the ileum. I am in accord with this statement. It is unfortunate that the term "incompetence of the ileocecal valve" should have been used in the discussion of this condition for the term has been used mistakenly to designate as pathologic what is actually the normal escape of material from the large bowel into the small when the cecum is overdistended. It is now generally recognized that the opaque material will normally flow from the large bowel into the small following overdistention of the cecum, especially if the ileocecal area is manipulated. The behavior in the cases with amebic infections, however, has been entirely different from that just mentioned and by the experienced examiner should readily be recognized as pathologic. The passage of material from the large bowel into the small in treated cases may continue to be somewhat more free than normal even after the bowel becomes normal otherwise. In such cases it would seem that the abnormality is the result of past disease rather than an indication of continued activity of the infection.

The deformity of the cecum has been constant in form except after treatment has been instituted, when contraction waves appeared and usually continued to be present until the cecum returned to normal. This characteristic is in marked contrast to the ulcerative form of tuberculosis in which active spasm is a characteristic finding. Hyperplastic tuberculosis of the cecum may simulate exactly the cecal changes sometimes seen in amebiasis and may be primary in the ileocecal area. However, according to Brown and Samp-

son (7), this form of intestinal tuberculosis is rare and the primary type exceedingly rare. I have seen one case considered to be hyperplastic tuberculosis that exhibited all the above changes including the ex-



Fig. 1. Case 1. Cecal pouch almost completely obliterated. Terminal ileum distended. Area of narrowing in transverse colon considered to be due to invasion of the bowel wall by the *Endameba*.

tremely rapid escape of the opaque material from the large bowel into the small. In this individual there was an active tuberculous lesion in the chest and a lesion causing a partial obstruction in the ileum. The diagnosis seemed apparent and tuberculous lesions of the ileum and cecum were demonstrated at operation.

It has been said by others that the lesions of the cecum may be indistinguishable from early carcinoma. This certainly is not true in cases in which the infection involves not only the cecum but other parts of the large bowel as well, which is true in the large majority of cases. In my cases, even when the cecum alone was involved, the changes were such that I felt justified in saying that the lesions were not carcinomatous.

I have had little experience with the acute bacillary dysenteries but in the few seen the type of ulceration has been different from the subacute and chronic amebic cases. The ulcerated portion of the bowel has been continuous, changes have been most marked in the distal part of the bowel, and the cecum has not been involved. It is probable that the infection may extend into the cecum in some instances and cause changes similar to an amebic infection. In such cases, however, amebiasis can be ruled out, for the trophozoites or cysts should readily be demonstrable by an adequate stool examination in any case with an active dysentery in which there are changes in the bowel wall that are at all extensive if due to amebiasis. Chronic ulcerative colitis may simulate an amebic infection closely and may extend into the cecum, but again the two should readily be differentiated by adequate stool and sigmoidoscopic examinations.

Changes in the Bowel Distal to the Cecum.—In the cases studied and classified as subacute or chronic amebic dysentery, the ulcerated areas in the bowel distal to the cecum have seldom been continuous but have been separated by apparently healthy portions in contrast to the usual continuous involvement seen in chronic ulcerative colitis and acute infectious colitis. One exception to this was a case that apparently was proven to be both chronic amebic dysentery and chronic ulcerative colitis. In acute amebic dysentery the involvement may simulate closely the changes seen in other forms of acute dysentery.

The so-called amebic granuloma may exactly simulate a carcinoma but in my cases each lesion has been accompanied by definite changes in the cecum that were considered indicative of an amebic infection. Again, an adequate stool examination should determine the diagnosis in the large majority of such cases or a therapeutic test may be resorted to if necessary.

The Stool Examination.—An amebic infection of the large bowel should not be con-

sidered ruled out unless on three consecutive days, after saline catharsis, trophozoites or cysts fail to be demonstrated in the bowel content by a competent paracytologist. I have been impressed by the frequency with which one receives the answer that a stool examination has been done and is negative when the possibility of an amebic infection is suggested and how frequently the findings are positive when an adequate examination is done. It should be recognized that many laboratories are not competent to make this diagnosis although they may be quite reliable otherwise.

The Sphere of the Roentgen Examination.—The roentgenologic examination is not a primary diagnostic method. It will seldom yield information of value in the examination of the healthy carrier or the individual with very mild clinical symptoms. In acute amebic dysentery the diagnosis can usually be made by the stool examination and this is the obvious method to employ. In these cases the bowel is generally so irritable that the roentgenologic examination is very unsatisfactory and the changes present may not differ from those seen in other forms of acute dysentery.

In chronic amebic dysentery the stool and sigmoidoscopic examinations are again the primary diagnostic measures, but here the symptoms may be such that the possibility of amebiasis may have been overlooked or the specific organism not have been found in the stool. A presumptive diagnosis of amebiasis may lead to a more careful examination and result in a positive diagnosis or may make possible the confirmation of a presumptive diagnosis by a therapeutic test followed by re-examination of the colon. In at least one-third of my cases the possibility of an amebic infection was first considered only after a presumptive diagnosis of amebiasis had been made following the roentgenologic examination of the colon. A contributing factor in this may have been the fact that in some instances other pathology was also present, two patients having duodenal ulcers and one, gall-bladder disease.

The roentgenologic examination is of primary importance in demonstrating the extent and severity of the disease and in determining the response to treatment. The stool may become free from parasites

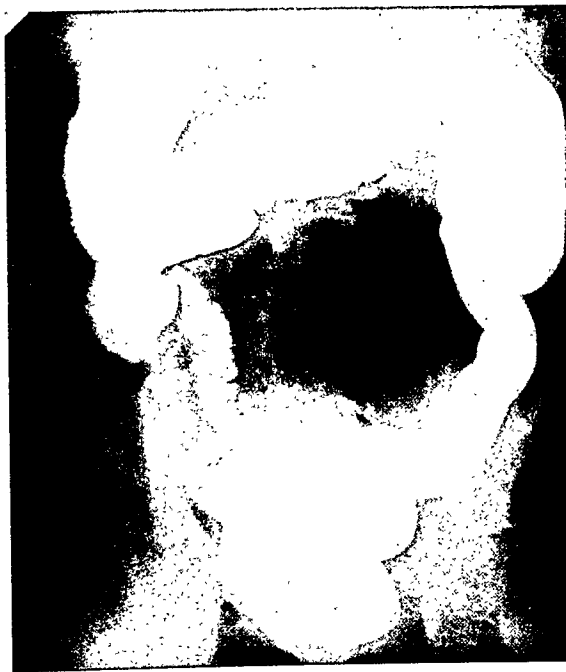


Fig. 2. Case 2. Dependent half of cecal pouch narrowed and slightly irregular in contour. Slight narrowing of first part of ascending colon. Terminal ileum distended. Changes suggestive of amebic infection but not characteristic.

long before the bowel returns to normal and until the bowel is normal it would seem unwise to consider the patient free from the disease.

The Experiences of Some Others with the Roentgen Examination in this Disease.—Manson-Bahr (8), head of the clinical division of the London School of Hygiene and Tropical Medicine, says that his experiences with the roentgenologic investigation in this disease have been very disappointing. Dr. Mather Cordiner, the head of the x-ray department of the Hospital of Tropical Diseases, in a letter to Manson-Bahr writes as follows concerning the changes in the cecal area observed in his cases: "From my own experience, I do not regard the deformity described [re-

ferring to the cecal deformity described by me before the Southern Medical Association] as being diagnostic of amebic dysentery. My own feeling at the present moment is that we can only indicate the

ing in conjunction with Ruffin of the same institution, says that in a series of 54 cases with amebæ in the stools, 19 were examined by x-ray and abnormalities considered to be due to amebiasis were found



Fig. 3. Case 2. Serial films of cecum made during treatment showing type of contraction of cecum frequently observed shortly after anti-amebic therapy has been instituted.

presence of a colitis radiographically, but I am unable to find any radiographic manifestations to indicate the specific nature of the lesion."

A. A. deLorimier (9), of the Gorgas Hospital, Panama Canal Zone, says that it has been his experience that the cecum is the part of the large bowel most often affected. He looks for flattening of the haustral markings, residual flecking, and for extension into the distal part of the bowel. He attaches no significance to escape of material from the large bowel into the small unless it rushes past the valve with no apparent delay whatever.

Reeves (10), of Duke University, work-

in the colon of 68 per cent of these. What he considered to be cecal involvement was present in 38 per cent of this group. In one instance there was a lesion that closely simulated a carcinoma but there was also cecal invasion. Ruffin (11) says that in no case in this group could the diagnosis of amebic dysentery be definitely established from the x-ray findings alone.

J. Cash King (12), of Memphis, Tennessee, found in a series of 12 cases with *Endameba histolytica* in the stools that there were abnormalities in the large bowel considered to be due to the amebic infection in each. The cecum was found to be abnormal in eight and in three the pos-

sibility of an amebic infection was first suspected when suggested by the x-ray findings.

As will be seen from the above communications, there is a marked difference in the opinions of workers as to the value of the roentgenologic examination in this disease as well as to what each considers the significant variations from normal.

Case Reports.—Case 1. I. B., a white adult male, entered Norton Memorial Infirmary on Nov. 11, 1937, with a history of abdominal discomfort, loss of weight, malaise and diarrhea for a period of one year previous to admission. The stool contained pus, mucus, and at times blood.

A gastro-intestinal examination was done. The upper gastro-intestinal tract was normal. The barium enema showed localized areas of irritability in the transverse portion of the colon. The mucosal folds were not well defined. The cecal pouch was almost entirely absent and the opaque material rushed from the large bowel into the small with no delay in the ileocecal area. The possibility of an amebic infection was suggested and a stool examination revealed numerous very actively motile amebæ to be present.

Re-examination one week after treatment was instituted showed the cecum to be larger and considerable irritability to be present. The appendix filled and irregularities suggestive of ulceration were seen. The bowel movements became normal one month after treatment was instituted, the patient gained weight rapidly, and is now well from a clinical standpoint. He has not returned for a follow-up examination as requested.

Case 2. M. M. M., a white adult male, 45 years of age, entered the Norton Memorial Infirmary on Feb. 20, 1938, with a history of right upper quadrant pain, temperature, and diaphoresis of ten days' duration. He gave a past history of a persistent diarrhea at the age of ten years. He went to New Mexico where his health improved and the diarrhea ceased. He was well until 14 years ago when, at the age of 31, he had a severe illness char-

acterized by high temperature, right upper quadrant pain, and tenderness in the right upper abdomen. A laparotomy was done and two liver abscesses found and drained. The material removed proved to be sterile upon culture. The post-operative convalescence was uneventful. Elevations of temperature for a brief period took place at intervals of about two years after this illness. These were controlled by intravenous injections of mercurochrome or gentian violet. Twelve years ago emetine was used in medication for a short time, although amebæ had never been found in the stool.

The patient had been free from symptoms for a period of three years prior to Oct. 1, 1937, when he again developed a high temperature, right upper quadrant pain, and diaphoresis. The bowel movements were normal at this time and had been normal at all times after his visit to New Mexico in childhood.

A proctoscopic examination was done which was said to have been normal. A blood examination showed the hemoglobin to be 62 per cent. The red blood cells numbered 3,240,000 and the white blood cells 10,500. A roentgenologic examination of the chest and gastro-intestinal tract showed the right side of the diaphragm to be slightly elevated and the respiratory excursion to be markedly limited. The cecum showed definite decrease in the size of the lumen and there was a rush of the opaque material from the large bowel into the small as the cecum filled. In interpreting the findings, the possibility of an amebiasis both of the liver and colon was suggested. A stool examination the following day, after saline catharsis, revealed many actively motile amebæ considered to be *Endameba histolytica*. Thorough anti-amebic treatment is in progress. The temperature subsided promptly and marked clinical improvement has taken place. Re-examination on May 3, 1938, showed the position and excursion of the diaphragm to be normal. The tone of the cecum was still increased and the margins were not well defined. Improvement was

evident but the bowel still showed what was considered to be evidence of disease.

Case 3. This patient, white adult male, went to his neighborhood physician with a history of having been constipated for



Fig. 4. Case 3. Cecal pouch obliterated. Terminal ileum greatly distended. Localized area of narrowing in transverse colon considered to be due to invasion of bowel wall.

years, until October, 1933, when he began to experience soreness in the lower abdomen after which he developed a diarrhea. This was followed by a perirectal abscess that ruptured spontaneously. The diarrhea continued from that time until the time that he visited his present physician although various forms of therapy were prescribed by other physicians. His present physician made x-ray films of his colon after a barium enema and sent them to my associate, William Curry Martin, M.D., for an opinion as to the nature of the changes present. It was Dr. Martin's opinion that they were those of an amebic infection of the large bowel. A stool examination was recommended and at the second examination after saline catharsis many actively motile amebæ were found.

I re-examined this patient one week later. There were irregularities in the wall of the sigmoid and descending colon characteristic of ulceration. The lumen of this portion of the bowel was definitely narrowed. The



Fig. 5. Case 3. Narrowing of lumen of proximal half of rectum and distal third of sigmoid with irregularities in margins of bowel wall considered due to ulceration.

lumen of the cecum was almost completely obliterated and there was a rush of the opaque material from the large bowel into the ileum.

Under treatment the patient has improved greatly: the diarrhea has been controlled, the bowel movements are normal, and the weight has increased markedly. From the clinical standpoint the patient is well at present. He has not returned for re-examination as requested, as yet.

COMMENT

My purpose in presenting this communication, and the earlier ones, has been to call attention to the changes that may be found in this disease. These changes have all been described by others prior to me

and my observations are simply a confirmation of their findings. I do not believe that the x-ray examination should be considered a primary factor in the diagnosis of this disease nor that an x-ray diagnosis of amebiasis should be made unsupported by clinical and other laboratory findings. In my very limited experience, however, no case has been seen presenting changes thought to be characteristic of this disease, in which subsequent investigation or a therapeutic test has failed to confirm the accuracy of the presumptive diagnosis.

BIBLIOGRAPHY

(1) VALLARINO, J. J.: Intestinal Amebiasis. *Am. Jour. Trop. Med.*, 5, 149-156, 1925.

(2) Idem: Copy from original paper presented before the Royal Society of Tropical Medicine and Hygiene, in London, in 1928, enclosed in a personal communication to the writer.

(3) WEBER, HARRY M.: Discussion of (6).

(4) Idem: The Roentgenologic Identification of Commonly Encountered Chronic Ulcerative Diseases of the Colon. *Am. Jour. Roentgenol. and Rad. Ther.*, 30, 488-496, October, 1933.

(5) BELL, JOSEPH C.: The Roentgen-ray Examination of the Colon in the Study of Amebiasis. *South. Med. Jour.*, 29, 462-472, May, 1936.

(6) Idem: Roentgenologic Studies of the Large Bowel in Infections by *Endameba histolytica* Before, During, and Subsequent to Treatment. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 916-924, June, 1938.

(7) BROWN, LAWRASON, and SAMPSON, HOMER L.: Intestinal Tuberculosis. Second Edition, p. 142. Lea and Febiger, Philadelphia, 1930.

(8) (9) (10) (11) (12) Personal communications in answer to inquiry concerning experiences with roentgen-ray examination of the large bowel in amebic dysentery.

THE TREATMENT OF HYPERTHYROIDISM, WITH A CONSIDERATION OF OTHER OF THE DUCTLESS GLANDS AS A TRIGGER MECHANISM

BASED UPON THE OBSERVATION OF 360 CASES¹

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FOR a radiologist to discuss the treatment of hyperthyroidism by any method except radiation therapy to the thyroid only, might result in an indictment of heresy, because it seems that we are being jammed into this thing called specialism by the public, and by the medical profession as well.

About two decades ago my interest in medicine, generally, was suddenly diverted to the field of radiology, and in due course of time I became affiliated with that specialty. It was, therefore, natural that I was soon referred to as "an x-ray doctor." True to orthodoxy, I tried to act the part of a specialist, and see things medical from the viewpoint of a radiologist. For instance, in the therapeutic field of x-ray I would treat a case of thyrotoxicosis, directing my entire attention to the thyroid gland, and wait for a responsive cure. If my efforts did not result in a cure, I was sorely disappointed, and wondered why the case did not respond favorably. Likewise, I also found the surgeon upset by many recurrent goiters after sub-total surgical removal, and he, too, wondered why his efforts were futile.

Close analysis of my patients and a study of endocrinology finally delivered me from the specialist complex, and gave me a new birth into the realm of medicine. Now, after two decades of trying to practise a specialty, I am forced to admit that such a thing as a specialty in medicine, according to the accepted definition, cannot exist.

The human body is one composite unit, and one organ cannot be vitally or dangerously affected without affecting other parts.

If we keep informed of the laboratory findings of the physiologist and the endocrinologist, we must be convinced that the ductless glands are so inter-related that to affect one and not another is impossible. I shall make no attempt at laboratory-proven inter-relationship of the endocrine system, for the beaches of this uncharted sea are strewn with wrecked fantastic hypotheses. I shall back my assertions by the teachings and investigations of those who lead in this little-known field of pathology and by the presentation of cases suffering from this thyroid syndrome. These patients are well now, cured by attention directed in part, or wholly, to another part of the ductless gland system than the thyroid itself. I shall try to show that pathological changes in one gland may affect another gland, may stimulate or perhaps depress. I shall present cases of so-called thyrotoxicosis that, without doubt, were activated by other parts of the endocrine system and were relieved by attention to other of the ductless glands, giving little attention to the thyroid.

In contradiction to my former effort to cure thyrotoxicosis by the application of x-ray to the thyroid alone, I am proposing that we accept and put into practice present-day laboratory teachings, and discard the ideas and practices of men long since dead. We should base our treatment upon correct interpretation of an impaired correlation of endocrine forces. I am not proposing to prove that some other gland is having a synergistic or inhibitory influence upon the thyroid, but to show there are almost always symptoms pointing to other endocrine dysfunctions which may give us the proper lead. Many times we are unable to put our finger upon all the disturbing factors, but a careful history as

¹ Read before the Radiological Society of North America at the Twenty-fourth Annual Meeting, at Pittsburgh, Nov. 28-Dec. 2, 1938.

to previous health and present behavior, environment, and hereditary factors, and also closely analyzing the patient as to temperament, etc., may lead us into the right analysis. We may be forced, and often are, to choose the method of "trial and error" to control a thyrotoxicosis. Occasionally we are not able to place the blame upon any but the thyroid itself, and are then forced to direct our efforts entirely to that gland. In such a case there is only one thing to do, namely, to break the endocrine cycle. This may be accomplished by attacking the thyroid, and this, in a certain number of cases, may produce a cure. Many of these same cases would perhaps be benefited as rapidly and just as satisfactorily if we should attack the chain at some point other than the thyroid, but to handle any case in this manner is by no means scientific for we may treat the effect and not the cause. Infrequently we see a case with a gland large enough to be producing sufficient mechanical pressure to demand instant relief, and surgery in such cases is advisedly employed. The colloid non-toxic thyroid does not come under the head of this discussion and is, therefore, not considered. I am frequently confronted with complex cases, impossible for me to diagnose at once, but there is "saving grace" for me in the fact that even the endocrinologist does not always quickly make a satisfactory diagnosis in endocrine upsets. So if I recognize the fact that a thyrotoxicosis may be secondary to an endocrine imbalance rather than being a thyroid entity, I will come through with the approval of the endocrinologist and physiologist, and it is my opinion that, in this complex field of human illness, these scientists stand supreme.

In the past, as soon as symptoms referring to a hyperthyroid and an increase in metabolism were encountered, I, as radiologist, or you, as surgeon, condemned only the thyroid and applied to it our agencies of cure.

It is surprising to see young men walk from the tutelage of the physiologist and

forget or disregard the vegetative nervous system, which so often holds the key to the door that guards the secrets of endocrine activity.

All these lamentations are merely the expressions of a "penitent sinner" who is exhorting himself and his brethren to view the endocrine system, each gland vitally related to the others. When one is thrown out of synchronism, then another may be stimulated or depressed. Our ability to evaluate and locate the etiology of thyrotoxicosis will be in direct ratio to our knowledge of the ductless gland system. If we are not able to diagnose correctly, our therapeutic ability will continue to be guess-work of "the hit and miss" variety.

The female species of the human race seems more susceptible to goiter than the male, with a ratio of five to one. Perhaps this is because there is a constant evolutionary change in the ductless glands of the body, from the age of adolescence until the climacteric has established a new endocrine balance. If she does not develop all the endocrine system perfectly, glandular synchronism cannot obtain, and if synchronism does not harmoniously evolve in the ductless glandular system, we may see the development of a hyper- or hypo-active thyroid gland, a depressed adrenal, a hypofunctioning of the pancreas, or a hyper-active pituitary.

The internal secretion of the thyroid may be entirely under the control of the anterior pituitary, through its thyrotropic hormone, and perhaps affected by the behavior of the adrenals and sympathetic nervous system also. Toxins of disease act upon nervous systems as a whole, which may stimulate or depress the adrenal and/or thyroid activity.

Pottenger states:

"Unfortunately we cannot differentiate the effects of toxemia as it expresses itself in the endocrine glands from that expressed through the nervous system. There are important endocrine glands, however, which are stimulated by it, particularly the adrenals and thyroid. These derive their activating nerve supply from the sympathetics, hence are stimulated to increased activity by toxins. The result is in-

creased metabolic activity. One can readily understand, then, that toxemia exerts a multiple influence which favors loss of weight, a depressed function of the gastro-intestinal organs which fail to provide sufficient pabulum, an increased metabolic activity which hastens the breaking down of the body tissues, and an injury to cells which interferes with assimilation."

In a given case in which some toxemia is productive of an increase in metabolism and the thyroid syndrome, neither x-ray nor surgery would be palliative or beneficial, but, on the other hand, might be destructive. In a given complex case in which the metabolic forces have been upset by some imbalance of the endocrine system, relief may be brought to the thyroid sufferer by breaking the cycle at any place in the system. In such a case, thyroidectomy or suppression to the pituitary or ovarian activity by x-rays may be equally effective, and in such a case the method employed may be, and should be, controlled by the following factors: (1) method least hazardous to life; (2) shortest time out for treatment; (3) expense of method employed.

In deciding why a given case is a victim of thyroid syndrome, we are burdened with the responsibility of showing our ability as internists and, in doing so, we look first for focal infections, pathological entities, and abnormal functioning of another factor of the endocrine system. We must also employ the aid of what the physiologist and endocrinologist have to offer. What we wish to do is to devise a treatment to be applied to the cause and not the effect. In other words, the so-called goiter may be the effect and not the cause of the patient's illness.

The following cases have helped to mature my present opinion concerning the treatment of hyperthyroid syndrome. My awakening began when a young woman school teacher was finally diagnosed as a victim of hyperthyroidism by her brother who was a doctor, and who called me to treat her. She was 26 years of age, married, and had no children, and was suffering from a symptom-complex that had been ushered in by a menstrual period. Her

sickness was first diagnosed appendicitis and then ectopic pregnancy. When the period had passed and all the pain had disappeared, she was still nervous and had a fast heart, *et cetera*. At the time she was diagnosed as hyperthyroid. X-ray treatment to the thyroid produced a slow gain and it was noted that during each succeeding menstrual period for the following four months, all symptoms were increased and almost all of the ground gained in the interim was lost. My conclusions were that her menstrual cycle was the trigger mechanism which set off her thyroid activity, and I determined upon x-ray sterilization. I secured her consent, and treatment by x-ray to the ovaries produced a menstrual cessation. Her basal metabolic rate automatically came to normal within three months' time. She has been well since 1926. This spectacular recovery determined me to sterilize other goiter patients, if their menstrual cycle offered a clue as the trigger mechanism, when their consent could be secured.

Observation of the peculiar behavior of some of my patients prompted me to classify many of them suffering from hyperthyroidism as the victims of a "symptom-complex." Consultation with endocrinologists, and a study of their literature on the inter-relationship of the endocrine system, convinced me that the thyroid, when over-active, might be synergized by another of the ductless glands, or else the over- or under-activity of other endocrines might throw the thyroid out of normal activity.

As above indicated, my first impressions of diseased thyroid meant that it alone needed attention. My observations in private practice have convinced me that the relationship of the endocrine system is so varied and complex, that I am forced often to tell my patient that it may take me a few weeks to decide fully as to the trigger mechanism in her particular case. There are cases of hyperthyroidism synergized by, or hindered by, the pituitary, adrenals, or ovaries, whose vicious cycle may not be *permanently* broken when at-

tention is given only to the thyroid. I have just emphasized *permanently*, for with the treatment directed wholly to the thyroid gland, there may be a complete failure of any method used, and a recurrence of symptoms, and in cases in which a sub-total removal is practised, even a recurrence of the gland itself.

I have previously reported a mother, 26 years of age, with two children, who had a sub-total thyroidectomy performed twice, once in 1936 and again in 1937, and in 1938 had a third return of the gland, larger than ever before. Her mother died of goiter when the patient was six years old. She has two sisters and one brother who are suffering now from goiter. Examination showed a nervous woman, anemic and almost hysterical from fear of death from goiter. Her weight was 93 pounds, menstruating normally every 28 days, libido considerably increased. Pulse rate 120, basal metabolic rate +26, exophthalmos +2. Thyroid enlargement was 10×10 cm., and protruded 2.5 cm. (in other words, the gland was as large as half a medium sized orange). The subject looked such a poor risk that I almost refused her case, and I informed her husband that I might be several weeks in deciding what other gland or glands beside the thyroid were in the "hook-up," to make her so ill and her response to treatment so obstinate. I made the following statement to him and often make it to others: "To know the cause of hyperthyroidism is often to have accomplished half the cure."

One with a +26 basal metabolic rate would not be expected to be as ill as this patient appeared to be. Her heart rate was too high for an ordinary thyrotoxicosis, and, to my mind, this implicated other glands, probably the adrenals and pituitary. I applied x-rays to her thyroid at weekly intervals and began a close analysis of her at each visit. Her nodular, or Plummer, thyroid gland did not soften; her basal rate stood still; her heart action remained fast; there was no gain in weight, or desire for food. Even though the patient was growing slightly weaker and more

nervous, her libido sexualis remained 100 per cent above normal level. This observation made me believe the hypophysis was her trigger mechanism, and influenced my decision to discontinue thyroid radiation and turn to raying the pituitary and the ovaries. The tide immediately turned and at the end of four months she had gained 23 pounds, her heart rate was 72, the gland one-third reduced, her exophthalmos reducing, and all tremor gone. She looked well and was taking care of household duties and her place in society.

It was formerly my opinion that all victims of hyperthyroidism were thin or losing weight. This is not always true. I present a case of a young girl, 16 years of age, who was very fat and nervous and with moderate hyperplasia of the thyroid. There was a beginning divergent strabismus. She was on a restricted diet to control her weight. Examination revealed an easily excited girl, who cried often, who could not lie still, and was sleeping poorly. Her heart rate was 140, her basal metabolic rate was +45, her height five feet six inches, and her weight 155 pounds. Menses were normal. Treatment to the thyroid and hypophysis was instituted. Quinine hydrobromide was given to slow her pulse, and bromides to produce sleep. Improvement was noticeable at the end of four weeks. Her nerves were quiet, crying had ceased, her pulse rate had decreased, and the basal rate had made a gradual decline. The strabismus had improved until she could resume her studies, and at the end of four months she was dismissed as symptom-free.

These and many other experiences lead me to believe that most thyroid symptoms are secondary to other glands of the endocrine system, and that the pituitary is first, the ovary second, and the suprarenal third, as primary to hyperthyroidism. The following case of increased metabolic rate was unquestionably secondary to suprarenal insufficiency: School teacher, age 24, had pneumonia, empyema and rib resection, followed by slow convalescence, with menses lasting almost continuously

for several weeks. Curettement and medication afforded no relief. She was anemic, weak, and had a yellow-bronze skin with seborrheic acne. It was the acne that brought her to my hands. Among other things, examination revealed that she had a basal metabolic rate of $+116$. She was leaving for the West Coast, and could not have x-ray at that time. I prescribed for her anemia some one of the liver and iron tonics. Her color and general apathetic condition made me suspect her adrenals were hypo-active, and cortin was given for this condition. She followed the treatment for six weeks while on the Pacific Coast, and when she came to see me again she was a well woman, with a basal metabolic rate of $+10$. I am convinced that her adrenals were hypofunctioning, caused from the influenza and pulmonary involvement, and in some way her thyroid was stimulated into this severe activity. Sugar tolerance and blood cholesterol tests were not done, as time did not permit. Three years have passed and she remains well. She has had no x-ray and no surgery. If she had remained in my city at the time I first saw her, I would have given her roentgen treatment and would have credited x-ray with having made a wonderful cure.

For one to place confidence in a stereotyped remedy, whether medicine, x-ray, or surgery, is to me the height of absurdity. I attribute the most satisfactory results of the last few years of my thyroid experience to having taken each case of thyroid disturbance on its own merits, and worked out the diagnosis of the causative factor of the dyscrasia, by scientific tests, insofar as is practical and known, or by "trial and error." If I am slow to find the exact combination of endocrine upset, I empirically reduce the activity of the thyroid, to the point of a normal metabolic rate, by x-ray. I admit this to be a poor practice, but some of the thyroid syndrome cases are so complex, there is nothing else left to do. I am consoled by a personal communication from William Wolfe, who states that, "In many of these so-called thyroid cases, it is difficult to tell whether the thyroid

was affected first and the other glands later or whether the reverse was the course of events. In either case, it is a vicious circle and it is perhaps of minor importance at which point it is broken."

In a personal communication from another one of America's recognized endocrinologists, in the discussion of the treatment of hyperthyroidism, he states: "It is my opinion that advocating total thyroidectomy in all cases of hyperthyroidism, is pernicious and unwarranted."

Still another internationally known endocrinologist writes me:

"Hyperthyroidism, so called, is but seldom a primary disease of the thyroid gland. I have reason to believe that the cause of the trouble is an extra-thyroid metabolic disorder in the course of which the thyroid is over-stimulated, and participates in the disease as a secondary manifestation. The beneficial results of surgery are comparable to those of amputation of an extremity for peripheral vascular disease. The amputation does not check the disease, nor the gangrene, which develops as its manifestation, but merely the organ on which the disease made its most conspicuous appearance."

There are surgeons who now advocate a total thyroidectomy who once held up their hands in holy horror, in fear of the radiologist producing a case of myxedema. These same men now propose to do a total thyroidectomy, thereby producing a positive myxedema in every case. An unvarying plan of treatment for any disease now, especially a toxic goiter, should be proclaimed from the housetops, as outlawed medicine for the treatment of hyperthyroidism should not in any manner be a stereotyped affair. In addition to roentgen ray, I often find myself employing biologicals, to boost a gland that is dysfunctioning, whose inactivity in some way may have been the synergistic factor in producing a hyperactive thyroid.

SUMMARY

Thyrotoxicosis is considered a symptom of endocrine imbalance rather than an entity.

One or more glands of the endocrine system may be a causative factor of thyroid disturbance which may be synergistic, or depressant.

Several cases of thyrotoxicosis have been reported that were cured by x-ray treatment to the pituitary, ovaries, or suprarenals, giving little or no attention to the thyroid.

Almost all cases considered had x-radiation to some part of the endocrine chain, and frequently endocrine substances were employed as an aid.

Many endocrinologists have been consulted, many of whom consider surgery as a very faulty step in the correction of thyrotoxicosis.

To adhere to the idea that thyrotoxicosis is always a surgical entity, instead of a symptom, shows our disregard for, or our ignorance of, scientific development. It is Wolfe's idea that, to treat the thyroid as an entity, shows that *living men think dead men's thoughts and pursue dead men's ideals, mere ghosts of belief—ideals from which time has sapped all substance and meaning.*

The adherence to the beaten path indicates that we are engulfed by a *dogma which we, the living, receive as a command from the dead.*

The endocrine system lends itself so freely to the use of x-rays and our biologicals serve so well in many cases, that I feel a new epoch is dawning in the handling of thyrotoxicosis, when x-radiation will supersede surgical interference.

REFERENCES

- (1) JENKINS, I. WARNER: Roentgen Therapy of Hyperthyroidism. Texas State Medical Association, at El Paso, May, 1921.
- (2) Idem: X-ray Treatment of the Thyroid. Read before McLennan County Medical Society, Sept. 8, 1924.
- (3) KEMP, W. N.: Status Lymphaticus: Adrenal Thyroid Syndrome. Canad. Med. Assn. Jour., 29, 506-514, November, 1933.
- (4) THURSTON, E. W.: Comparison of Hypertrophic Charges in Thyroid Caused in Different Species by Acid Extract of Anterior Lobe of Bovine Pituitary Gland. Arch. Path., 15, 67-77, January, 1933.
- (5) JENKINS, I. WARNER: The Incidence of Therapy of Thyroid Diseases. Texas Twelfth District Medical Society, 1934.

(6) RONY, H. R.: Rôle of Hypophysis in Thyroid Syndromes. Illinois Med. Jour., 66, 234-239, September, 1934.

(7) THOMPSON, W. O., TAYLOR, S. G., III., and MEYER, K. A.: Factors Influencing Operative Mortalities in Exophthalmic Goiter. Ann. Int. Med., 8, 350-359, September, 1934.

(8) ZONDER, HERMANN: The Diseases of the Endocrine Glands, ed. 3, p. 114. William Wood & Company, Baltimore, 1935.

(9) SHELLING, D. H.: The Parathyroids in Health and Disease, p. 114. C. V. Mosby Company, St. Louis, 1935.

(10) LOEB, L.: Phillips Memorial Prize Oration: Thyroid Stimulating Hormone of Anterior Pituitary Gland. Ann. Int. Med., 9, 13-18, July, 1935.

(11) BARROW, S. C.: Intensive Radiation in Hyperthyroidism. New Orleans Med. and Surg. Jour., 88, 679-682, May, 1936.

(12) KAPLAN, IRA I.: Radiation Therapy: Its Use in the Treatment of Benign and Malignant Conditions, p. 268. Oxford University Press, New York, 1937.

(13) MEANS, J. H.: The Thyroid and its Diseases, pp. 399-400. J. B. Lippincott Company, Philadelphia, 1937.

(14) SAXTON, J., and LOEB, L.: Thyroid Stimulating and Gonadotropic Hormones of Human Anterior Pituitary Gland at Different Ages and in Pregnant and Lactating Women. Anat. Rec., 69, 261-279, Oct. 25, 1937.

(15) SCOTT, A. C., JR.: Surgery of Recurrent Exophthalmic Goiter. Texas State Jour. Med., 32, 649-652, February, 1937.

(16) WOLFE, WILLIAM: Endocrinology in Modern Medicine, W. B. Saunders Co., 1937.

(17) MCCLEOD, J. J. R.: Physiology in Modern Medicine, pp. 833-844, C. V. Mosby Company, St. Louis, 1938.

(18) JENKINS, I. WARNER: Diseases of the Thyroid Gland and its Pleuriglandular Relationship. Texas State Jour. Med., September, 1938.

(19) FEIRER, W. A. (Medical Division, Sharpe & Dohme): Personal communication.

(20) GOLDZIEHER, MAX: Personal communication.

(21) HUTTON, JAMES H.: Personal communication.

(22) LUCKE, RICHARD (Department of Clinical Research, Abbott Laboratories): Personal communication.

(23) WATSON, E. H.: Personal communication.

(24) WEAVER, M. M. (Director of Professional Relations, Eli Lilly & Co.): Personal communication.

(25) WOLFE, WILLIAM: Personal communication.

DISCUSSION

I. WARNER JENKINS, M.D. (*closing*): I wish to thank Dr. McConnell¹ for his liberal and enthusiastic discussion, and pay my sincere respects to my critics (who have many times forced my back to the wall), whose relentless opposition to my efforts in radiation therapy of the thyroid syndrome has served as a stimulus as no other medium could have done.

¹ Not returned for publication.

edema," or other symptoms resulting from deficient absorption may be presenting symptoms which overshadow the diarrhea.

Radiological Examination.—Although the history, stool examination, or enemas or meals containing colored substances may be of help, a satisfactory radiological examination is of prime importance in establishing the diagnosis and determining the cause of the gastrocolic fistula.

The fistulous tracts as shown in some of the autopsied cases of our series were sometimes small, meandering, irregular passages. It is not remarkable, therefore, that on occasion these passages may be blocked by mucous membrane folds, food particles, or by the edema caused by a concomitant inflammatory process. Rare instances of spontaneous healing have been reported. Usually, however, the diarrhea—after a remission—again recurs.

From the radiologic standpoint these characteristics of the fistulous tract are of great importance for they explain why a gastrocolic fistula may not be detected at certain stages, or why a barium enema may readily show the connection, while the barium meal—apparently because of a valve-like mechanism—will not show any abnormality. Of our cases there were three in which the gastrocolic fistula was demonstrated by the barium enema, but not by the barium meal (Figs. 4 and 5).

Although the actual tract in the carcinoma cases is often readily demonstrated, in the gastro-enterostomy cases the connection is usually not visible for two reasons. The first is that 75 per cent of all gastrojejunal ulcers are at the stoma (4) and, hence, the fistulous tract has very little actual length: the second, because the barium may follow any one of three pathways. It may go through the duodenum and thence promptly fill the jejunum, or it may follow the gastro-enterostomy, or may go directly into the colon. Because of this "three-ring-circus effect," the actual connecting segment is usually covered by barium-filled bowel before it can be detected.

The highly irritating gastric contents may cause inflammatory changes in the mucous membrane of the colon (Fig. 6) which closely resemble those of ulcerative colitis, and a perforation from ulcerative colitis may, there-

fore, be suspected as the cause of the gastrocolic fistula.

Prognosis.—The prognosis is grave in cases unoperated upon. Operation is made difficult because of the numerous defects in bowel walls which must be repaired and the danger of contamination from colon contents. In our 12 cases including the five carcinomas, all patients except two were dead within a month after admission. These two had had surgical intervention. Many of the others were considered too ill for surgery.

CONCLUSIONS

1. Gastrocolic fistula occurs most frequently as a complication of gastrojejunostomy or because of perforations of stomach or colon carcinoma.
2. The outstanding symptoms are intractable diarrhea with loss of weight and dehydration.
3. Radiologic examination is the best method of demonstrating these fistulous tracts, but because their irregular walls sometimes exert a valve-like action, either the barium meal or barium enema alone is not sufficient to rule out the presence of such a fistula. Of the two methods the barium enema is more likely to show the abnormal passage.

BIBLIOGRAPHY

- (1) BARGEN, J. A., KERR, J. G., HAUSNER, E., and WEBER, H. M.: Rare Complications of Chronic Ulcerative Colitis: Colonic Intussusception: Colojejuno-gastric Fistula. *Proc. Staff Meet., Mayo Clinic*, 12, 385-391, June 23, 1937.
- (2) FAIRLEY, N. H., and KILNER, T. P.: Gastrojejuno-colic Fistula, with Megalocytic Anemia Simulating Sprue. *Lancet*, 2, 1335-1341, Dec. 19, 1931.
- (3) FARDELMANN, A. v. P.: Gastrojejunocolic Fistula: Brief Review of the Literature and Report of a Case. *Am. Jour. Surg.*, 36, 527-530, May, 1937.
- (4) LAHEY, F. H., and SWINTON, N. W.: Gastrojejunal Ulcer and Gastrojejunocolic Fistula. *Surg., Gynec. and Obst.*, 61, 599-612, November, 1935.
- (5) POYNTON, F. J., and MACGREGOR, J. V.: Gastrojejuno-colic Fistula with Edema. *Lancet*, 2, 240, 241, Aug. 2, 1930.
- (6) TOLAND, C. G., and THOMPSON, H. L.: Acute Perforation of Gastrojejunal Ulcer: Report of Ten New Cases and Review of 93 Collected Cases. *Ann. Surg.*, 104, 827-852, November, 1936.
- (7) VERBRUGGE, J.: Gastrocolic Fistula. *Arch. Surg.*, 11, 790-808, November, 1925.
- (8) WILBUR, D. L., and EUSTERMAN, G. B.: Nutritional Night Blindness: Report of Case. *Jour. Am. Med. Assn.*, 102, 364-366, Feb. 3, 1934.

THE ECONOMIC STATUS OF THE RADIOLOGIST UNDER SOCIALIZED MEDICINE:
A Report on Germany¹

In Germany the health of the individual is controlled by the government from the cradle to the grave. Socialized medicine in some form has been in effect in that country since 1883. At the beginning it was a system of sickness insurance for certain groups and occupations. During the intervening years so many social and medical conditions have arisen and so many controlling laws enacted that to-day it is a very complicated system. The tendency has been to abolish the establishment of separate funds and to care for the masses on a wage-earning or income basis. The benefits to be paid to a workman during illness; his care and that of his immediate family; the premiums to be paid for such service, and the class of care to be given are all regulated by law.

In Germany at the present time there are four kinds of health insurance:

1. The community or local obligatory insurance (*Orts-und Betriebskrankenkassen*).
2. The obligatory commercial health insurance (*Ersatzkassen*).
3. The private insurance companies (*Privat-krankenkassen*).
4. The welfare authorities (*Wohlfahrts-aemter*).

The welfare authorities are not insurance companies in the proper sense of the word, but are institutions supported by the State or community funds for the treatment of the poor. The funds used for the care of the poor are derived from taxes and donations and are similar to welfare disbursements in America. The individuals receiving benefits do not contribute or pay premiums as in the case of the insured persons, in other words such benefits are purely charity.

All employed persons who earn 300 marks and less a month are legally obliged to be members of one of the health insurance companies (mentioned under 1 and 2, above). The com-

mmercial insurance companies are entitled to admit members of the commercial professions only. The commercial members can choose between the first two forms of insurances.

With an income above 3,600 marks a year, it is understood that a person can afford to pay for his medical services or has saved enough to care for himself or members of his family in event of a catastrophic illness. Due to the income stipulation for employed person and with a fairly high income bracket, it is compulsory for the greater part of the wage-earning population to carry some form of health insurance.

The obligatory insurance is regulated by the government and in each community is the local, or *Orts Krankenkassen*. Private insurance companies promoted by private capital are as strictly controlled by the government regulations as are the other types of health insurance.

The private insurance companies—*Privat-krankenkassen*—admit all persons who wish to have an insurance protection against diseases, independent of their monthly income. Members of the private companies are also various other persons, such as the state and community officers of the lower classes and such persons as independent workmen and, therefore, not admitted to the legal health insurance, although they have an income of less than 300 marks per month. In addition, those wealthy persons who wish to have health insurance may obtain a policy from the private companies. Therefore, many of those of moderate means who may do so belong to the *Krankenkassen*. In a way it is only the wealthy and those who do not care to purchase protection that are to be found without insurance.

The premiums are different in different classes, and according to the premiums the disbursements in money are also different. It is usual that in the higher classes not more than 80 per cent of the doctor's bills are paid to the members or subscribers. In this way the companies avoid a too frequent calling of the physician by the patient. The amount for hospitalization, operations, x-ray examinations, x-ray treatment, etc., is paid in full in the highest

¹ Prepared at the request of the Inter-Society Committee for Radiology by S. W. Donaldson, M.D., Ann Arbor, Mich.

contribution class and only in percentages in the lower classes.

The affairs of the local *Orts* are administered by a committee, who are elected, so that of the group two-thirds represent the employees and one-third the employers. This committee must see that each *Orts* is self-supporting and that the money received is sufficient to pay all salaries, benefits, fees, disbursements, administration costs, and to provide for buildings and their upkeep.

Patients under the health insurance scheme are allowed to select their doctor or hospital. When one becomes a member of one of the obligatory insurance plans he is furnished with an alphabetical list of physicians and specialists in his community. If the patient does not consult one of the approved physicians, then he must pay the bill himself. Ward class hospital care is provided; if he prefers better accommodations, he must pay the difference, and if he prefers a private physician then that fee must also be paid by the patient. In case of illness or injury the insured must obtain from the *Krankenkassen* a permit or sickness slip (for which he pays a separate fee) and this slip authorizes the physician to render service. The contracts provide for a specified number of weeks of medical or hospital care each year. There are approximately 7,000 approved *Krankenkassen* in operation in Germany at the present time.

The financial scheme of the sick was devised after a study of the cost of medical care. Since its inception the premium paid by each worker from his monthly income has varied from below 2 per cent to over 6 per cent. At the present time it is about 3.5 per cent-4 per cent. One-half of this premium or contribution is paid by the employer and one-half by the employee. The average contribution for a wage earner up to 300 marks a month is 3 per cent and, for those with a higher salary, the average contribution is accordingly higher. That is, a sliding scale prevails as it pertains to the income, the contribution, and to the benefits.

Thus about 80 per cent of the entire population are subscribers to some form of health insurance. The medical treatment for these subscribers and all accommodations in the ward class of the hospitals including operations, x-ray examinations, and treatments are free.

The remuneration paid to those doctors who are admitted to the legal and obligatory health

insurances (*Krankenkassen*) is a very small one. A physician can make only a modest living from such work and must see many patients a day and obviously has little time for study or recreation.

The obligatory commercial health insurance plans (*Ersatzkassen*) pay a little more, and thus the physician who has many commercial employees as patients can expect to better his income.

The private health insurance companies (*Privat-krankenkassen*) do not pay to the physician directly, but only to the members. They demand from the members that the physician's bills must be balanced by the patient himself before they give any compensation. The company allows the member 80 per cent of the total amount and the patient pays the other 20 per cent; as stated above, this procedure tends to discourage the patient from too many visits to his doctor.

All of the health insurance companies are strictly controlled by the government and a special authority (*Reichsversicherungsamt*) has been set up for this purpose.

Any approved physician is entitled to make x-ray examinations for the purpose of a first orientation. This is especially true in regard to fluoroscopic surveys. A special commission made up of radiologists has the power of extending to general practitioners the privilege of making roentgenograms. This commission also investigates the qualifications of the specialist. This commission considers his professional education, his special training, and his equipment. It also passes upon his qualifications to administer roentgen therapy, and, in addition, may test the accuracy of his instruments for the measurement of dosage. In addition to its duties of determining the qualifications of men seeking to enter the field of roentgenology, it has control of the settlement of accounts of the radiologists for services rendered to health insurance patients.

The commission is entitled to approve diagnosis and the quality of films. This is intended to avoid inferior work by recognized radiologists, and to improve or eliminate those men who show insufficient training. This control commission, organized by the radiologists, in a way guarantees that the insurance companies pay only for a high grade of work. The radiologists feel that it has been advantageous to them in that it has upheld the grade of work accepted by the insurance companies,

and they, in turn, realize that they can well afford to pay reasonable fees as long as a high standard is maintained. In all cases it has been desirable to have a representative of the insurance company as a member of such a commission.

Specialists are entitled to make x-ray examinations and to administer x-ray therapy in their specialty only, such as, the surgeon is not allowed to examine a stomach, the dermatologist may give only superficial therapy, etc. All deep therapy must be administered by an approved radiologist.

In Germany there are four sources of roentgenological consultation available to all physicians:

1. *The Central X-ray Departments in the Large Hospitals.*—All patients of all departments of the hospital are examined or treated in these central departments under the direction of some prominent roentgenologist and his assistants.

2. *Special X-ray Departments in the Different Branches or Departments of the University Clinics and Some Big Hospitals.*—Such departments are not so numerous as generally believed and a great deal of their time is devoted to research. By dismembering radiology as a unit and establishing a unit for each specialty, there is a tendency to develop specialists within a specialty. Such a situation is probably inevitable in very large departments.

3. *The Central X-ray Department of Some of the Large Public Health Insurances (Krankenkassen).*—The insurance companies exert pressure upon their members to go to these institutions, and in this manner constitute the greatest competition to the private roentgenologist and to the x-ray departments of the hospitals.

4. *The Roentgenologist with a Private Office and, at the Same Time, Possibly in Charge of the X-ray Department of One of the Smaller Hospitals on a Part-time Basis.*—The private office practices exist only in the cities and large metropolitan centers, as a small town could not support such a practice. The ability to show a profit in such an office is directly dependent upon the number of patients. The small fees paid by the public health insurance groups are sufficient to maintain a private x-ray practice, if a minimum number of 150 patients monthly are examined or treated. If as many as 300 patients are seen each month, then a profit can be expected. The earnings of a

private office practice having more than 300 patients monthly are sufficient for a profit and also a reasonable renewal of equipment and the purchase of additional improvements. Offices with less than 300 patients monthly will have considerable difficulty in respect to purchasing new equipment or replacing old and obsolete machines unless the greatest economy is exercised and excellent care given to the equipment already installed.

The greatest competition for the private x-ray office lies in the radiological departments of the local or community health insurance organizations. As all x-ray work must be agreed to by these organizations before it can be carried out, it is necessary for the patient to go to the large and modern buildings which have been built, the *Orts*, or local insurance company. This gives them the opportunity to urge the patient to go to the so-called "*Eigenbetrieben*," e.g., the proper department.

The compensation for the radiologist's hospital work is often a fixed salary from 400 to 800 marks per month and in some of the larger institutions a higher salary is paid. In smaller departments the radiologist gets a percentage of the receipts, usually after a deduction of a certain rate for the cost of films, chemicals, and other overhead expenses.

For the diagnostic x-ray service as well as for therapy there are regulations which determine the amount of fluoroscopy allowed or the number and size of the films to be made for every condition. These restrictions have been made to prevent unnecessary films and to require the radiologists to be extremely economical. In case the radiologist deems it necessary to make additional exposures and use more than the allotted number of films in order to arrive at a diagnosis, he must do so at his own expense, or give special reasons why more than the allotted number of films was necessary. The radiologist must have a large number of patients in order to absorb any deficit occurring in such a manner.

The German Roentgen Society (*Deutsche Roentgenengesellschaft*) has agreed upon rates for the expenses incident to each examination and these figures are the bases of the different tariffs. The German Roentgen Society is consulted by the authorities in all difficult economical questions pertaining to roentgen diagnosis or roentgen therapy. A close co-operation between the radiologists and the prac-

tioners is urged and desired, and it may be said that it exists in most cases from a medical viewpoint, but in matters of economics their interests are sometimes divergent.

There are two main tariffs for radiology in Germany: the "*Preussische Gebuehrenordnung*" (Preugo) and the "*Allgemeine Deutsche Gebuehrenordnung*" (Adgo). The "Preugo" distinguishes a rate for costs of films, material, etc., and a rate for the radiologist's fee, including the report. The rate for the costs is different, according to the size of the films used.

Size: 9×12 cm., 13×18 cm., 18×24 cm., 24×40 cm., 30×40 cm., Fluoroscopy.

Marks: 3.0, 4.50, 5.20, 6.0, 7.75, 3.25.

The fee for the radiologist is 5.0 marks for the first exposure or, as termed, application of the x-ray apparatus, and 3.35 for the second and subsequent applications up to five during the same examination. A few examples of the method used in submitting charges as allowed are as follows:

Complete Examination of the Chest.—One fluoroscopy and one film 30×40 cm. For this is paid 7.75 marks for the film and 3.25 marks for the fluoroscopy, making a total of 11.00 marks for expenses, and, in addition, the radiologist receives a fee of 5.0 marks for the first application (filming the patient) and 3.35 marks for the second application during the same examination, or a total of 19.35, or, at the present rate of exchange of approximately 40 cents a mark, the equivalent of \$7.65.

Complete Gastro-intestinal Examination.—Three fluoroscopies are allowed and, at most, two 18×24 cm. films and one 24×30 cm. film, making a total of five applications of the x-ray apparatus. The fee for this is 21.75 marks and the expenses paid are 25.35 marks, making a total for the examination of 47.10 marks. A complete examination with the above number of films and fee is paid only in complicated cases. The total fee for the average gastro-intestinal examination is about 35.0 marks.

Gall-bladder Examination.—Two 18×24 cm. films and one 24×30 cm. film; fee 11.75 and expenses 15.60 marks for a total of 27.35 marks.

Examination of the Knee Joint.—Two exposures on one 24×30 film; fee 8.35 and expenses 11.00 marks or a total for the examination of 19.35 marks.

Examination of the Hand.—Two exposures on one 13×18 cm. film; fee 8.35 and expenses 4.50, total 12.85 marks.

The "Adgo" has only a so-called "organ tariff" which is higher than the "Preugo." This tariff provides a fixed payment for examination of the different organs, for example: Lungs, 28 marks; stomach and duodenum, 35 marks; complete gastro-intestinal, 50 marks; wrist, 15 marks. This tariff is paid by all commercial obligatory insurance organizations (*Ersatzkassen*). A complete examination, including fluoroscopies and report, is to be furnished for these rates, independent of the number of films used or number of applications of the x-ray apparatus.

For radiation therapy the "Preugo" and the "Adgo" distinguish between superficial and deep therapy. The regulations for therapy are as follows: In superficial therapy the fee paid is per area. The fee paid is for the treatment of one field with the so-called effective dose, irrespective of the number of applications or "sittings" or the filtration used. The fee paid per area is for irradiation of that area, 5.0 marks plus 5.0 marks for expenses. The maximum size of an area is 17×17 cm. and six areas are paid for in every single disease. A large amount of superficial therapy is carried out by the dermatologists in their own offices and, because of these innumerable treatments, the tariff has been made low: 10 marks per field in the "Preugo" and 15 marks in the "Adgo."

For deep therapy, only allowed to be carried out by approved radiologists, the "Adgo" pays somewhat more than the "Preugo"; for instance, a complete treatment for cancer of the uterus costs approximately 135 marks in the "Preugo" and 155 marks in the "Adgo." Deep therapy charges depend upon the effective dose. In carcinoma of the uterus the fee amounts to 100 marks and the expenses allowed are 35 marks. The effective depth dose for such a treatment is set at 2,500 r.

The prices for work done by private radiological offices correspond in general with the prices of the "Adgo." Only a few prominent radiologists get more. In cases of legal proceedings the "Preugo" is taken as the basis for discussion by the authorities.

A new general German tariff for all medical work has long since been announced by the present medical authorities, but it has not yet gone into effect. According to the best private information available, the fees for radiology will be between the prices now in force in the "Adgo" and the "Preugo."

The radiologists have no direct settlement with the patients whose insurance is compulsory. The settlements with the legal insurance companies go by way of an organization which is directed by physicians. All receipts of the obligatory insurance organizations are carefully checked by the controlling medical organization to see whether the individual physician exceeds the average of other physicians in his bill, both as to amount charged and to the amount of work done. Reductions occur in all cases in which the amount of the physician's bill is too high.

The medical organization pays to the radiologists as well as to all practising physicians a round sum which is derived from the amount paid in by the members of the insurance company. Payments are made every quarter and a final settlement is made at the end of the last quarter of the next year. At the time of the final settlement, if a difference exists between what the physician has been paid and what is due to him, he is credited with the amount due him or, if overpaid, that amount is charged against him.

In preparing the schedule of expenses all existing costs such as films, chemicals, a percentage of rent, technicians' salaries, depreciation on equipment, and minor overhead expenses were given consideration.

Every physician is obliged to give exact reports about his patients. A report is transmitted to the insurance company, one to the examining board, and one must be retained by the radiologist. The following information must be sent on each patient to the commission which settles the account, or the bills submitted to them by the radiologist:

1. Name, Christian name, age of the patient.
2. Statement of the disease.
3. Kind of radiologic treatment. If diagnostic services were rendered, the number of fluoroscopies as well as the number and size of the films must be included. If therapy, then the number of irradiations and the total r dosage must be given.
4. The roentgen diagnosis.
5. Name and address of the referring physician.
6. Calculation of charges divided into expenses and fee.

In summary of this report it may be said that the following important factors show the

present set-up of the economic status of the radiologist in Germany:

(1) All employed persons in Germany with an average monthly income of less than 300 marks must be in an obligatory insurance organization.

(2) All other persons can buy a policy of a private insurance company protecting them in case of illness or disease. The compensations paid are dependent upon the contribution or premiums paid into the company.

(3) About 80 per cent of the population of Germany is in one of the various insurance schemes.

(4) The radiologist is paid according to two different tariffs, the "Adgo" and the "Preugo."

(5) The profit-making ability of a private x-ray practice is strictly dependent upon the average number of patients each month. The minimum number is considered to be 150.

(6) The greatest competition is that of the x-ray departments of the obligatory insurance companies.

(7) Radiology is practised in Germany by central x-ray institutes, special x-ray departments, private offices, and the x-ray departments in the general hospitals.

(8) Payments for radiological services are made by a special commission of radiologists who supervise the qualifications of those desiring to practise radiology, and audit all accounts submitted.

Germany to-day has a very large proportion of the population under a strictly regulated socialized medical scheme. The paper work, and as termed in this country "red tape," is a tremendous task, although probably not as much as for the occasional WPA case seen by the private practitioner in this country.

As has been shown, the minimum number of patients per month necessary for operation of an x-ray office at a profit is 150. In view of this fact it is interesting to make comparisons of the fees allowed in Germany, and the present fee schedule was adjusted and arranged in consultation with the German Roentgen Society, with the fee schedule adopted and put into effect in this country by the CWA and carried on to the WPA. Considering the present rate of exchange of .40 cents for the mark, the fee allowed under socialized medicine in Germany for the x-ray examination of a hand is \$5.14 and the WPA allowance (if claim is not disallowed) is \$2.50. For a knee the fee is \$7.74, and WPA \$2.50; a chest \$7.65 as

against \$3.75, and for a complete gastro-intestinal \$18.84 as compared to \$12.50. Undoubtedly the experience of the German system since its introduction has produced better cost accounting in the matter of radiologic examinations than that used by the authorities who suggested the CWA and WPA fee schedule for such services.

It is easy to see that the administration costs of operating such a system of socialized medicine are great. The fees paid to the general practitioner must, of necessity, be low in order to pay the physicians on salary, the nursing staff, druggists, and lay clerical help. An enormous sum is already invested in the buildings and equipment, and maintenance costs and replacements must be taken from the money paid in by the workers. It, therefore, stands to reason that, in order to meet the administration costs and pay

salaries to the large number of employees, very little is left to be apportioned to the physicians for their professional services. It is needless to say that the specialist fares better than the practitioner under such a system.

There are lessons to be learned from the experiences of the German radiologists and it is sincerely hoped that even in this short report there is enough material to give the American radiologist some food for thought upon the question of government control of the practice of medicine.

I wish to thank those radiologists in Germany who were kind enough to give me economic information and also to thank Dr. Marum, of Greenville, Miss., and Dr. Seilmann, of New York City, for their suggestions and criticisms in the preparation of this report.

S. W. D.

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—*Chairman*, Karl M. Bonoff, M.D., 1932 Wilshire Blvd., Los Angeles; *Secretary*, Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—*President*, E. N. Liljedahl, M.D., 1322 North Vermont Ave., Los Angeles; *Vice-president*, M. L. Pindell, M.D., 670 South Ferris Ave.; *Secretary*, Wilbur Bailey, M.D., 2007 Wilshire Blvd.; *Treasurer*, Henry Snure, M.D., 1414 South Hope Street. Meets every second Wednesday of each month at County Society Building.

Pacific Roentgen Club.—*Chairman*, Lyell C. Kinney, M.D., San Diego; *Secretary*, L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—*Secretary*, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—*President*, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president*, K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary*, E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer*, H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—*Chairman*, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer*, Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

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Georgia Radiological Society.—*President*, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president*, William F. Lake, M.D., Medical Arts Bldg., Atlanta; *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—*President*, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president*, Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer*, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—*President*, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president*, Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer*, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, *Chairman*, and Warren W. Furey, M.D., 6844 Oglesby Ave., Chicago, *Secretary*.

INDIANA

Indiana Roentgen Society.—*President*, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect*, Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president*, A. C. Holley, M.D., Attica; *Secretary-Treasurer*, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—*Chairman*, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary*, Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

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Vice-president, Clarence Hufford, M.D., 421 Michigan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

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Minnesota Radiological Society.—President, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; *Vice-president*, Leo G. Rigler, M.D., University Hospitals, Minneapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—President, L. G. Allen, M.D., 907 N. 7th St. Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—President, Paul C. Schnobelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—President, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—President, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Ray Society.—President, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island

College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—President, Walter Matlack, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

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Long Island Radiological Society.—President, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—President, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—Chairman, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Associated Radiologists of New York, Inc.—President, Albert L. Voltz, M.D., 115-120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. J. Francis, M.D., 121 Madison Ave., New York City; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—President, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—*President*, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Vice-president*, R. V. May, M.D., St. Luke's Hospital, Cleveland; *Secretary-Treasurer*, Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President*, B. M. Warne, M.D., Doctors Building, Cincinnati; *Secretary-Treasurer*, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—*President*, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; *First Vice-president*, Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; *Second Vice-president*, Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; *Secretary-Treasurer*, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect*, Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; *Editor*, William E. Reiley, M.D., Clearfield. Annual meeting, May, 1939. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—*President*, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president*, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary*, Barton H. Young, M.D., Temple University Hospital; *Treasurer*, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—*President*, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; *Secretary*, Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—*President*, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; *Secretary-Treasurer*, Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—*President*, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Vice-president*, Steve W. Coley, M.D., Methodist Hospital, Memphis; *Secretary-Treasurer*, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—*President*, Jerome H. Smith, M.D., San Antonio; *President-elect*, C. F. Crain, M.D., Corpus Christi; *First Vice-president*, M. H. Glover, M.D., Wichita Falls; *Second Vice-president*, G. D. Carlson, M.D., Dallas; *Secretary-Treasurer*, Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—*President*, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president*, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary*, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—*President*, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary*, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—*President*, H. W. Hefke, M.D.; *Vice-president*, Frederick C. Christensen, M.D.; *Secretary-Treasurer*, Irving I. Cowan, M.D., Mount Sinai Hospital, Milwaukee. Meets monthly on first Friday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—*Secretary*, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September

University of Wisconsin Radiological Conference.—*Secretary*, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

RADIATION THERAPY AND GLANDS OF INTERNAL SECRETION

Investigations and experimental observations in recent years in the field of medical research have obtained valuable information concerning the function and effects upon the human body of the glands of internal secretion, and this knowledge has opened another important field for radiation therapy. Its principal use has been in functional disturbances of the thyroid, parathyroid, pituitary, ovary, adrenals, breast disturbances, and bone dyscrasias.

This form of therapy is not new, since for over twenty years radiation therapy has been applied to the pituitary gland for various gynecological conditions, and recently this form of therapy has been given to this organ in certain cases of diabetes mellitus and so-called essential hypertension. While favorable results have been obtained with this type of therapy, there arose the question as to whether therapeutic doses of x-ray can influence non-adenomatous pituitary glands. Recently, Lawrence, Nelson, and Wilson, of Yale University, answered the question by certain experimental work on the radiation of the pituitary gland of female albino rats. These investigators believe that their experiments suggest that non-adenomatous human hypophyses can be influenced by therapeutic doses of the roentgen ray.

Lacassagne conducted certain experiments on female animals by destroying their hypophyses with radium and observing the effect on their ovaries, which showed considerable changes. One-third of the anterior lobe suffices to preserve the usual genital activities, even if the remainder of the anterior and the entire middle and posterior lobes are completely destroyed. Many years ago, Biedl and Aschner showed that extirpation of the anterior lobe of the pituitary in young animals produced atrophy of the ovaries and uterus. The same result was produced by Gellar by intensive roentgen-ray radiation of the pituitary. The work of Dixon and Marshall established definitely the inter-relationship between the pituitary and the ovary.

It is interesting to note that Tierney and Engelbach believe that both subjectively and objectively the function of the pituitary gland is dualistic. Thus, disease of the gland may cause amenorrhea, dysmenorrhea, epileptiform attacks, obesity, headaches, definite changes in the osseous, genital, and dermal systems, increased blood pressure, fever, and involuntary muscular contractions.

While the effects and results obtained by radiation of the pituitary gland are well known, similar knowledge concerning the adrenals is less well understood, particularly as it concerns blood pressure. There have been numerous reports from investigators who maintain that the adrenals are not affected by therapeutic doses of roentgen ray. The experimental work of Cottenot, Frey, Pozzi, Stephan, and Strauss would appear to confirm this. On the other hand, the work of Zimmern and Baude offers a logical explanation of the results of roentgen-ray therapy to the adrenals. They believe that the normal adrenals are unaffected by therapeutic doses of x-ray in the same manner as the normal thyroid, but when adrenals are in a stage of hyperactivity, they respond in a similar manner to the hyperactive thyroid. However, they are of the opinion that the favorable results they obtained in radiating the adrenals for hypertension may have been due to an effect on the vegetative nervous system rather than on the adrenals. As far back as 27 years ago, investigations were made by Zimmern and Cottenot on the effect of radiation on the adrenals in human subjects with hypertension with favorable results.

Two years after Zimmern and Cottenot's observations, Eisler and Hirsch conducted certain experiments by destroying several rats with excessive doses of roentgen rays. They removed the adrenals soon after death and made an extract in physiological saline solution. They made a similar extract from the adrenals of unirradiated rats. They injected these extracts into the jugular veins of rabbits, while

the blood pressure was registered in the carotid. In the instance wherein the irradiation extract was injected, the blood pressure rose rapidly, but in a short time returned to normal. In the instance of the unirradiated extract, the rise in blood pressure was the same, but the elevation remained for a long time. Thus it would seem that radiation therapy over the adrenals does affect blood pressure.

Then, again, we find that the adrenals have been irradiated in cases of diabetes mellitus. Desplats, Langeron, and Bera used roentgen therapy over the adrenals in patients with diabetes mellitus. They report a diminution of sugar in the blood and urine. They believe that this reduction in sugar, provided that there is sufficient insulin in the blood, is explained on the basis of arterial dilation. The vegetative nervous system, being affected by this form of therapy, allows a better blood supply to the blood vessels of the muscles, producing an increased muscular combustion of blood sugar. It may be that the effect of roentgen rays on the vegetative nerves may be a direct one, since Langeron and his co-workers found an increase in the amount of urine immediately after roentgen therapy and before the sugar elimination was diminished. Then again, Desplats reports a case of diabetes mellitus that had arterial obliteration of the limbs in the form of intermittent claudication that was greatly improved with roentgen therapy over the region of the adrenals. Zimmern experienced the same findings. From these and similar observations, there are some who believe that perhaps the pituitary and adrenals are responsible for certain cases of essential hypertension, and also believe that they secrete a substance, when in a stage of hyperfunction, which produces hypertension and hyperglycemia. The application of radiation therapy to these glands will affect the hypertension and hyperglycemia.

The application of radiation to the pituitary in menopausal disturbances was first used by Werner, in 1923. In many quarters it is believed that as the pituitary becomes hyperactive the ovary becomes less active, and that aggravated menopausal syndromes are due to overactivity of the pituitary. Splendid results have been reported of the use of radiation therapy to the pituitary, not alone for menopausal syndromes, but also for menstrual deficiencies. This form of therapy is safe, when applied by a radiologist, for Borak cites that for the past thirty years children have been treated for tinea capitis with similar technical

factors and that no sign of damage to the hypophysis or brain tissue has ever been observed.

Certain experimental observations that have been reported concerning changes produced in the ovaries when the thyroid gland was radiated, seem to explain the known clinical fact that radiation therapy over the thyroid will stimulate ovarian function. In further substantiation of this fact, Coret states that disturbances of menstruation, oligomenorrhea, and amenorrhea, as is sometimes found in exophthalmic goiter, are explained as direct response to thyroid dysfunction. Then again, many favorable reports have been made concerning radiation therapy to the pituitary in cases of goiter which failed to respond to this form of therapy when applied only to the thyroid gland.

While it is true that roentgen therapy has been employed frequently for the relief of endocrine disturbances, and in certain instances proven more effective than the hormones themselves, we must not permit our enthusiasm to cause us to overestimate its value and make unreasonable predictions. A warning should be sounded to inexperienced physicians, owners of x-ray apparatus, against the indiscriminate use of radiation therapy in all cases of hypertension. Not only would such a practice occasion a distrusting attitude on the part of the physicians who refer their cases for therapy, but considerable harm to the patient might be the result. When applied judiciously and intelligently by an experienced radiologist, this form of therapy will prove of inestimable value in certain cases of hypertension, menopausal syndromes, and menstrual deficiencies, without producing any damage to the organ treated. We should ever remember that the success of a physician is based upon his skill and judgment, and not upon any particular agency by means of which he practises medicine.

REFERENCES

- (1) EISLER and HIRSCH: *Arch. d'électric. med.*, 1914.
- (2) LAWRENCE, J. H., NELSON, W. O., and WILSON, HUGH: Roentgen Irradiation of the Hypophysis. *RADIOLOGY*, 29, 446-454, October, 1937.
- (3) LACASSAGNE, A.: *Strahlentherapie*, 54, 477-492, 1935.
- (4) COTTENOT, P. H.: *Osteondes Rayon X sur les Glands Surrenaux*. Paris Thesis, 1913.
- (5) FREY, HANS: *Acta radiol.*, 9, 23-53, 1928.
- (6) POZZI, A.: *Policlinico sez. med.*, 32, 1925.
- (7) STEPHAN, R.: *Munchen. med. Wchnschr.*, 69, 1922.
- (8) STRAUSS, O.: *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 28, 1921.

- (9) ZIMMERN, A., and BAUDE, J.: *Presse méd.*, 37, 1929.
- (10) ZIMMERN, A., and COTTENOT, P. H.: *Comp. rend. Acad. d. Sci.*, 154, 1912.
- (11) WERNER: Cited by J. Borak, *München. med. Wehnschr.*, 71, 1924.
- (12) BORAK, J.: *München. med. Wehnschr.*, 71, 1924.
- (13) ZIMMERN, A.: *Bull. et mém. Soc. de radiol. méd. de France*, 20, 1932.
- (14) DESPLATS, R., LANGERON, L., and BERA, J. L.: *Presse méd.*, 39, 1931.
- (15) DESPLATS, R.: *Am. Jour. Phys. Ther.*, 8, 1932.
- (16) TIERNEY and ENGELBACH: *Goiter and Other Diseases of the Thyroid Gland*, p. 31 (by Arnold S. Jackson), 1926.
- (17) BIEDL and ASCHNER; DIXON and MARSHALL: *Principles and Practice of X-ray Therapy*. F. Roberts, London, 1936.
- (18) POHLE, ERNST A.: *Clinical Roentgen Therapy*. Lea and Febiger, Philadelphia, 1938.

COMMUNICATION

PROMOTION OF A FRIEND

The Editor begs to convey the following information, and to congratulate Mr. Cyrus S. Fleck upon his management of the highly technical business of printing RADIOLOGY. He was elected, in January, to the office of Executive Vice-president of the printing firm which holds the contract.

BOOK REVIEW

OUTLINE OF ROENTGEN DIAGNOSIS. An Orientation in the Basic Principles of Diagnosis by the Roentgen Method. By LEO G. RIGLER, B.S., M.B., M.D., Professor of Radiology, University of Minnesota. Atlas Edition. A volume containing 266 pages, and 254 illustrations. Published by J. B.

Lippincott Company, Philadelphia, 1938. Price: \$6.50.

For several years Doctor Rigler's notes concerning his lectures on roentgen diagnosis have been available in mimeograph form to his students at the University of Minnesota. Their popularity because of the concise presentation of the subject has spread to other institutions and the appearance of the revised notes in a more formal dress will be welcomed by teachers and students. The publication is available in two forms, one containing only the outline and index and the other, an atlas edition, in which the notes are supplemented by 227 figures including drawings and reproductions of roentgenograms. The author has used a new type of drawing instead of roentgenograms to illustrate many skeletal conditions. In a book of this sort, where cost to students is an important consideration, this may be necessary, but even though the drawings are of high quality they fail to portray the same information that is conveyed by a first-quality roentgenogram properly reproduced by modern printing methods. The bibliography is limited to 15 suggested text-books, which may be sufficient for the usual medical undergraduate—the post-graduate student, however, will find it inadequate.

On the whole, the author has produced an excellent synopsis of a rapidly growing subject. The arrangement is such that it should fit into most organized didactic courses concerning this specialty and therefore will be popular with undergraduate students. From the standpoint of the post-graduate, it is a cold academic presentation of basic facts that lacks the color of personal information based on a large amount of experience.

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ARTHRITIS

Massive Doses of Vitamin D in Chronic Arthritis: Its Effect on Calcium Metabolism. Charles LeRoy Steinberg. *Jour. Lab. and Clin. Med.*, 24, 17-24, October, 1938.

Daily, 160,000 U.S.P. units of Vitamin D were administered to 40 cases of chronic arthritis. Clinical improvement was noted in 35 per cent of the total number treated; 65 per cent were unimproved.

Initial serum calcium and phosphorus determinations were made in 32 cases. A detailed determination of calcium and phosphorus was carried out in 12 of the treated cases, varying in periods of from three weeks to one and one-half years.

The author found that such vitamin therapy would lower a high serum calcium; that it would raise a low or normal serum calcium to a higher level, and then, after continued administration, would again decrease the hypercalcium level. The clinical improvement or non-improvement, or even aggravation of existing joint symptoms, had no bearing on the change of blood calcium. The effect on the serum phosphorus was less marked.

From such a study one may conclude that the effect of massive doses of Vitamin D in chronic arthritis is non-specific, and that the improvement noted with this medication would fall in line with many other non-specific remedies employed in the treatment of this disease.

W. A. WARD, M.D.

BACKACHE

Hypertrophy of the Ligamentum Flavum as a Factor in the Production of Low Back and Sciatic Pain. Walter D. Abbott. *Jour. Iowa St. Med. Soc.*, 28, 266-271, July, 1938.

When there is a history of trauma followed in the course of a few weeks up to one to two years by low back pain with radiation in the distribution of one or both sciatic nerves, loss of sensation or strength, and absence of the Achilles reflex, hypertrophy of the ligamentum flavum must be considered. These ligaments stretch across the postero-lateral aspect of the spinal canal between the laminae. They are, normally, from one to four millimeters thick; when hypertrophied they may measure up to one or two centimeters in thickness. The etiological factor generally is trauma, although in some cases an inflammatory process may be the initiating factor. The history in most instances is that of injury to the back following lifting or falling. Upon the injection of lipiodol a notching of the shadow or in some cases a complete block may be present when the patient is observed in the supine position. Six brief case reports are presented together with illustrations of the conditions found at operation and photographs of removed specimens.

L. W. PAUL, M.D.

Displacement of the Intervertebral Cartilage as a Cause of Back Pain and Sciatica. Edgar F. Fincher and Exum B. Walker. *South. Med. Jour.*, 31, 520-526, May, 1938.

Herniated intervertebral disk, with spinal nerve root compression, should be borne in mind as a cause of back strain and pain.

The symptomatology consists of a radiating pain exaggerated by sneezing, coughing, or any activity momentarily raising the spinal fluid pressure; muscle spasm sufficient to straighten the normal lumbar curvature; limitation of motion such as straight-leg lifting; "listing" of the body, and variable neurologic findings.

X-ray studies are made both preliminary to and after injection of 5 c.c. of iodized oil into the subarachnoid space with fluoroscopy of the patient prone on a tilted table. A pathologic defect is visualized on at least three occasions before final diagnosis is made.

A quantitative protein determination on the first 2 c.c. of spinal fluid removed is a valuable aid in diagnosis. In almost every instance it is increased over forty milligrams per cubic centimeter.

The treatment advanced is laminectomy and removal of the herniation.

JOHN M. MILES, M.D.

BONE DISEASES (DIAGNOSIS)

Rare Disturbances of Osseous-cartilaginous Growth. F. Holldack. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 58, 1-18, July, 1938.

Two cases of rare disturbance of osseous-cartilaginous growth are discussed. The first case is classified as chondro-dysplasia, the second as chondro-dystrophy.

Chondro-dysplasia is interpreted as a congenital skeletal disease, characterized by irregularity and delay in ossification of the intermediary cartilage. Cartilaginous tissue, on which normal longitudinal growth of bones depends, does not undergo the normal process of ossification. Cartilage preserves its structure unduly long and, persisting in such form, gradually creates more or less voluminous masses, which frequently require abnormally long periods for transformation into osseous tissue. Simultaneously, one can encounter in the long tubular bones, particularly in the metaphyses, osteo-cartilaginous tumors which may be located subperiosteally or intramedullarily, and produce tumorous swelling of the bone. They transform para-epiphyseal, osseous segments into transparent, voluminous masses. The epiphysis persists as more or less cartilaginous structure, producing less osseous substance than a normal epiphysis at the same age. As a result of such proliferation in the regions of osseous growth, diaphyses and metaphyses may undergo considerable deformity.

The second case is characterized by a disturbance in ossification of normal epi- and apo-physal anlage, apparent roentgenologically by lack of lime substance and punctate transparencies of the involved skeletal

portions. Gradually, a bilateral coxa vara developed as a static deformity. Other skeletal parts are not involved by any gross deformity. Skeletal length is absolutely normal as is also the mutual relationship of component parts. Initially, classification of this case to any one of the well established clinical entities, particularly dyschondroplasia and achondroplasia, was not simple. Dyschondroplasia was ruled out in the absence of any disturbance in length and any deformity by cartilaginous proliferation.

A plea is made for a more logical classification of many a typical chondro-dystrophies, and a rather extensive discussion of the literature favors classification of many atypical disturbances of bony development under this title. Even Kashin-Beck's disease and osteo-arthritis might be considered under this classification.

H. A. JARRE, M.D.

Hodgkin's Disease of the Bones. Herman S. Lieberman. *Jour. Bone and Joint Surg.*, 20, 1039-1044, October, 1938.

The author presents a case of Hodgkin's disease primary in the lumbar vertebrae. A complete history and clinical findings are presented.

JOHN B. McANENY, M.D.

Sarcoidosis: Report of a Case. Wyndham B. Blanton. *South. Med. Jour.*, 31, 26-29, January, 1938.

A case of sarcoidosis is reported in a woman 27 years of age. The disease is interesting because of its characteristic bone changes and of its rarity. The case reported varies somewhat from the usual. The typical punched-out rarefied areas are present in the carpal bones, metacarpals, and phalanges, but there is also an associated arthritis of four years' standing. Skin lesions, nodules, infiltrations, etc., are absent in this instance. The microscopic appearance of the lymph nodes, although presenting the typical epithelioid cells with large vesicular nuclei, suggests earlier changes than have been observed previously.

JOHN M. MILES, M.D.

BONE DISEASES (THERAPY)

Osseous Dystrophy of the von Recklinghausen Type. M. Deluen. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 257, 258, April, 1938.

The clinical and roentgenographic features of a case of von Recklinghausen's disease are presented. The case was benefitted by roentgen therapy to the region of a fracture of the tibia.

S. R. BEATTY, M.D.

Roentgen Therapy in Acute Osteoporosis. E. B. Mumford. *Jour. Bone and Joint Surg.*, 20, 949-959, October, 1938.

Results here reported of radiation therapy of Sudeck's acute bone atrophy are very encouraging. The charac-

teristic atrophy appears shortly after injury in those parts composed of small bones and multiple joints. It is followed later by severe pain which is not relieved by heat or rest. In the film, the cortex is preserved but the medulla is mottled and the longitudinal trabeculae are indistinct.

Five of six cases treated received prompt relief and early function. The manner of action of the treatment cannot be explained. The technic used is with a tube output of 173 kw. (173 kv.?) at 6 ma., 0.5 mm. Cu + 1 mm. Al, from 30 to 40 cm. distance. Two or three treatments of from 150 to 200 r were given every two to three days for three treatments. The treatment can be repeated after six weeks, and again after two months.

JOHN B. McANENY, M.D.

Roentgen Therapy of Paget's Disease of Bone. R. Ledoux-Lebard. *Bull. et Mém. Soc. de Radiol. Méd. de France*, 26, 161, 162, March, 1938.

In the author's experience of 17 cases, roentgen therapy has not only relieved the pain of the bone lesions of Paget's disease in all but one, who received only one series of treatments, but also, in many of these cases, has caused some degree of recalcification.

His technic: 200 kv., 0.5 mm. Cu + 2 mm. Al filtration, 800 r given in weekly doses of 200 r for one series. Frequently relief follows the first series, infrequently two or three at intervals of six months are necessary, and relief from pain may last from several months up to years.

S. R. BEATTY, M.D.

Giant-cell Tumor of Bone. Bradley L. Coley and Norman L. Higinbotham. *Jour. Bone and Joint Surg.*, 20, 870-884, October, 1938.

This excellent presentation of experience in the treatment of giant-cell tumors accentuates several important points: the value of roentgenography and of biopsy in diagnosis; the occasional occurrence of malignant change and treatment. The findings of the authors lead them to believe that surgery and irradiation each has its place in treatment, the former showing the greater percentage of excellent end-results. The two types of treatment should never be used together as it is then that the greatest number of amputations follow.

JOHN B. McANENY, M.D.

BONES, TUMORS

The Roentgen Diagnosis and Treatment of Benign Giant-cell Tumor of the Bone. J. A. Meadows and K. F. Kesmodel. *South. Med. Jour.*, 31, 148-153, February, 1938.

Two types of benign giant-cell tumor are considered: a trabeculated and a non-trabeculated or "lysis" type. Eleven cases are reported. The treatment varies: if progressive calcification occurs, sub-erythema doses

are continued at from four- to six-week intervals; if new areas of destruction appear, heavier dosage is given.

From this experience the authors believe that the trabeculated type responds well to radiation therapy; that some giant-cell tumors heal or are arrested spontaneously, and that the non-trabeculated type should be treated, not only with x-ray, but also with surgery.

JOHN M. MILES, M.D.

Bone Tumors. C. A. Hellwig and C. H. Warfield. Jour. Kansas Med. Soc., 39, 302, 303, July, 1938.

Based on the facts collected by the Registry of Bone Sarcoma, the authors have prepared a chart showing the salient features of the various bone tumors and allied conditions. For each type of tumor are given the age incidence, sites of predilection, symptoms, x-ray findings, treatment, pathological picture, and prognosis.

L. W. PAUL, M.D.

Bone Tumors. George J. McChesney, Robert L. Carroll, and Kenneth S. Davis. Calif. and West. Med., 49, 64-68, July, 1938.

The clinical discussion of bone tumors by the above-named authorities is well worth reading. It describes clearly and comprehensively the symptoms, diagnosis, and treatment of these puzzling lesions.

JAMES J. CLARK, M.D.

THE BREAST

Roentgenologic Examination of the Normal Breast: Its Evaluation in Demonstrating Early Neoplastic Changes. J. Gershon-Cohen and Albert Strickler. Am. Jour. Roentgenol. and Rad. Ther., 40, 189-201, August, 1938.

A good description of the embryology, post-natal, and puberal development, anatomy, and menstrual changes of the normal breast is given.

Roentgen examinations were made on 142 normal girls and women—one study near the onset of menstruation, and another after an interval of fourteen days. The technic of examination is described in detail. The average factors used were 32 kv., 100 ma., 0.3 sec., 36 inches distance and par speed screens.

The roentgen findings were analyzed in relation to the menstrual, pregnant, and lactational history; age, height, and weight; previous breast operations and anomalies or derangements of the endocrine system. The authors state that they do not believe that the roentgenogram could give information concerning such changes as benign epitheliosis and adenosis, which make their appearance during puberty. The diagnosis of early neoplastic processes in the adult breast is complicated by intricate tissue architecture.

The roentgen examination of the breast, to be of real aid to the clinician, must reveal the pathologic changes in their earliest stages. The authors state that changes in, and addition to, the present roentgen technic may

make the examination more valuable. The roentgenologist should have a thorough and comprehensive knowledge of the roentgen appearance of the normal breast under all conditions of growth and physiologic activity.

IRVING I. COWAN, M.D.

The Roentgen Visualization and Diagnosis of Breast Lesions by Means of Contrast Media. N. Frederick Hicken, R. Russell Best, Howard B. Hunt, and T. T. Harris. Am. Jour. Roentgenol. and Rad. Ther., 39, 321-343, March, 1938.

An accurate study of the breast substance can be made by contrast media, of which thorotrast and CO₂ have been found to be the best.

Technic.—Under aseptic conditions from 1 to 2 c.c. of thorotrast is injected into the milk duct or ducts in question. After completion of the examination the substance is aspirated. If CO₂ is used, it is injected both into the pre-mammary and retro-mammary tissues. The CO₂ is absorbed in 15 minutes. Films are taken stereoscopically.

Diagnosis.—With visualization of the anatomical arrangement of the milk ducts and secretory mechanism, lipoma, fibroma, papilloma, cysts, galactoceles, and carcinoma have been diagnosed. In general, the malignant lesions show destruction and invasion, whereas the benign merely displace the normal structures. With the CO₂ aeromammogram, the lesion can be demonstrated as encapsulated or attached to the neighboring structures.

In a series of 625 mammograms only three abscesses have occurred, each following accidental extravasation of thorotrast into the periductal tissues. The only contra-indication of this type of study is acute mastitis.

S. M. ATKINS, M.D.

Extensive Calcifications in the Breast. Anton Kubat. Röntgenpraxis, 10, 689, 690, October, 1938.

Extensive calcifications of the breast were noted in a roentgenogram of a 78-year-old woman with Paget's disease. The roentgenologic literature available to the author did not give any reference to such a finding.

Calcifications in the breasts might be found after a mastitis, tuberculosis of a breast, or, most commonly, in adenomas.

In this case they were thought to be calcium deposits in multiple adenomas (bilateral, multiplicity, and structure).

HANS W. HEFKE, M.D.

CALCULI

The Radiological Aspect of the Treatment of Ureteric Calculus. D. G. Maitland. Med. Jour. Australia, 2, 38-40, July 9, 1938.

The radiologic investigation of the urinary tract may be listed as plain radiography, retrograde pyelography and pneumo-pyelography, and excretion pyelography.

A good film must show the kidney outlined and it must be free from extraneous shadows. All movement due to respiration must be eliminated since even slight respiratory movements may obliterate the shadow of a small calculus. Calculi composed of calcium oxalate cast a dense shadow, those composed of calcium phosphate cast a slightly less dense shadow, while those composed of xanthin or uric acid may cast no shadow, and, therefore, be invisible in a plain radiogram, even though they may be quite large. Large cystin stones easily cast a faint shadow but small ones are not apparent.

The author states that excretion pyelography depends upon the facility of the kidneys to excrete urea, since this substance is the vehicle by which the contrast substance passes through the kidneys. Excretion pyelography should be reserved for identification of shadows; the determination of the intrarenal or urinary situation of shadows; the approximate differential renal function, and the demonstration of coincident disease or anomaly in one or both kidneys. In discussing the differential diagnosis of various shadows which may occur upon a film, the author makes the following statement: Branched shadows superimposed over the kidney outline offer no difficulty, but shadows toward the peripheral and renal outline may be calculi, calcified tuberculous foci, calcified lymph glands, semi-organized blood clot, the necrotic areas of a suppurative pyelonephrosis, or even calcified areas sometimes found in hypernephroma or teratoma.

A calcified concretion in the tip of the appendix may simulate a right ureteric calculus. The retroperitoneal gland may be very difficult to differentiate.

W. H. GULLENTINE, M.D.

Calculus of the Bladder in a Case Previously Treated for Cancer of the Cervix. T. Nogier. *Bull. et mém. Soc. de Radiol. Méd. de France*, 8, 113, 114, February, 1938.

A woman treated intensively two years previously for carcinoma of the cervix developed suprapubic pain and hematuria. The pelvic examination revealed only a mass in the vesico-vaginal region, shown by cystoscopy to be a large bladder calculus.

S. R. BEATTY, M.D.

CANCER (DIAGNOSIS)

Primary Carcinoma of the Biliary System: A Clinico-pathological Analysis of 40 Cases. Rigney D'Aunoy, Michael Alexander Ogden, and Béla Halpert. *Surg.*, 3, 670-678, May, 1938.

The study is based on 40 cases from 6,050 autopsies at Charity Hospital, New Orleans, from Jan. 1, 1931, to Oct. 6, 1937. Twenty-three were primary in the liver, six in the extra-hepatic biliary ducts, and 11 in the gall bladder. Twenty of the patients were white (12 male, eight female) and 20 were colored (18 white, two female). One died in the second decade;

three in the fourth; eight in the fifth; 11 in the sixth; 14 in the seventh, and three in the eighth.

Of the 23 primary liver neoplasms, 16 were liver-cell, and seven were cylindrical-cell growths. All were primary in the extra-hepatic biliary ducts, and those in the gall bladder were cylindrical-cell growths.

In addition to local infiltration or spread by lymph or blood channels, there were metastases to regional lymph nodes and distant organs.

The majority of the cases of primary liver growths were jaundiced, all with growths of the extra-hepatic ducts were jaundiced, and most of the primary growths of the gall bladder were associated with jaundice and cholelithiasis.

The illness lasted for from two to 16 months, with an average duration of four and one-half months.

JOHN E. WHITELEATHER, M.D.

Two Cases of Gastric Cancer: The Difficulty of the Radio-diagnosis of Lesions of the Pyloric Antrum. P. Vasselle. *Arch. d. mal. de l'app. digestif*, 28, 166-174, February, 1938.

The diagnosis of pre-pyloric carcinoma is often difficult, as frequently the deformity is very slight, and at other times the element of spasm is predominant and persistent, simulating a lesion of some extent when actually a small lesion or none at all exists. Two illustrative cases are presented.

S. R. BEATTY, M.D.

CANCER (THERAPY)

The Treatment of Carcinoma of the Cervix Uteri. Ralph E. Myers. *Jour. Okla. St. Med. Jour.*, 31, 74-78, March, 1938.

The treatment of cervical carcinoma is wholly a radiological problem, but we are far from the point where we can be content with our results. Leading radiologists agree that the treatment should be continuous, somewhat protracted, and very intensive. The chances of a cure or of good palliation depend on the first series of treatment.

The author favors occasional moderate doses of radium, interspersed in the x-ray treatment, from ten days to two weeks after treatment is instituted. A specimen is removed for microscopic study. In questionable cases the microscopic study is made first.

A 34 per cent five-year cure is reported in a group of 32 cases, including Groups 1-4.

JOHN M. MILES, M.D.

Treatment of Skin Malignancy by Irradiation. Harold W. Jacox. *Pennsylvania Med. Jour.*, 41, 1126-1129, September, 1938.

Early skin cancer may be treated by electrosurgery, cautery, or irradiation.

Irradiation treatment is divided into three types: (1) selective active type in which the tumor is sensitive, as a basal-cell carcinoma, (2) caustic action, and (3) fractional irradiation.

For lesions up to 5 cm. in diameter, from 85 to 135 kv. of unfiltered irradiation is used. Basal-cell lesions are given at least 4,000 r in a series; squamous-cell at least 5,000 r; lesions 2 cm. thick, from 7,000 to 8,000 r. Larger lesions and those involving bone and cartilage are given from 100 to 300 r per day using 200 kv., highly filtered, until tissue tolerance (3,500 to 6,000 r) is given. Highly filtered gamma rays of radium in doses of from 200 to 500 milligram-hours contact, or 1,600 milligram-hours at 1 cm. distance may also be used. Radium has the advantage in non-ulcerating lesions. Case reports are given to illustrate the different technics the author describes in his article.

JOSEPH T. DANZER, M.D.

Results Obtained in Radiation Treatment of Inoperable Collum Carcinoma. Ivan de Büben. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 264-268, August, 1938.

The author studied 702 cases of inoperable collum carcinoma which were treated by irradiation during the ten years from 1919 to 1929, at Women's Clinic No. 1, in Budapest.

The method of treatment used combined radium and roentgen rays. A combination of vaginal and cervical application of radium was carried out with the dosage ranging from 4,000 to 6,000 mg.-hr. The treatment time was distributed over several weeks. Roentgen rays were applied externally, using from three to six fields and giving 1,500 r per field. Factors used were 190 kv., 5 ma., filter of 0.5 mm. Zn plus 0.5 mm. Al, 30 cm. skin-target distance.

There were 405 cases of five-year cures (that is, absence of symptoms) out of the 702 cases studied. Of these 405 cases under observation for five years, 38, or 9.3 per cent, were completely cured, and 43.1 per cent were symptom-free for at least one year.

IRVING I. COWAN, M.D.

Carcinoma of the Cervix and Breast: Prognosis and Preferable Therapy. Edward D. Greenberger. *Jour. Okla. St. Med. Assn.*, 31, 79-82, March, 1938.

Carcinoma of the cervix is classified clinically into Groups 1-4, according to the extent of the disease. Seventy-five per cent of all cases fall in Groups 3-4 and have a poor prognosis as to a five-year cure.

Radium is applied with a colpostat and a tandem in the uterus. The total dose varies from 2,000 to 4,000 mg.-hr. around the cervix, and from 3,000 to 6,000 mg.-hr. within the uterus. The Regaud technic is employed, giving small doses of radium continuously for from four to seven days.

X-ray therapy consists of from 150 to 200 r every other day to one of from three to six portals until from 1,200 to 2,500 r per portal have been given to the pelvis.

For Groups 1-2 cases, radium is applied first, followed by x-ray in a month or six weeks. For Groups 3-4, especially if pelvic infection is present, x-ray is given first, and often repeated two months after radium therapy.

Carcinoma of the breast is classified into three groups. In Group 1 the tumor is movable and confined to the breast. Surgery results in a cure in from 50 to 80 per cent of these cases, and irradiation plays a minor rôle. In Group 2 the tumor is movable and there are but few axillary metastases. Post-operative irradiation improves the percentage of five-year cures and reduces the number of local recurrences. Pre-operative irradiation employing doses of from 1,800 to 2,400 r to each of from three to four portals offers much promise in destroying the more sensitive cancer cells, confining the field of the growth, and preventing surgical transplantation. Operation is performed six or eight weeks later. In Group 3 there is diffuse involvement of the breast and extensive metastases. Operation is to be avoided.

JOHN M. MILES, M.D.

Cervical Lymph Nodes in Intra-oral Carcinoma: Surgery or Irradiation? James J. Duffy. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 767-777, May, 1938.

Surgery offers a better chance of cure in the operable group of carcinomas of this type, whereas in advanced stages radiation will produce a greater chance for at least a longer and more comfortable life.

Before surgery is instituted all of the following indications must be present: primary lesion controlled, limited to one side of the oral cavity and consisting of highly differentiated cells; cervical metastases limited to one group of nodes, or nodes in two contiguous cervical triangles; capsule of nodes not invaded; opposite side of the neck free of metastases; no distant metastases, and the general condition of the patient good.

Contra-indication to surgical treatment, except in the advanced cases in which no treatment is of avail, is an indication for radiation.

These conclusions are drawn from a study of 252 cases of carcinoma of the lateral border of the tongue, which may serve as examples of all oral lesions except those of the lip.

S. M. ATKINS, M.D.

Treatment of Carcinoma in the Pharynx and Larynx and its Results. Lionel Colledge. *British Med. Jour.*, 2, 167, 168, July 23, 1938.

Results of irradiation, according to this author, are neither so good as to supplant surgery nor so bad as to be discarded. The implication is that it is optional which method is used. The discussion is limited to epithelioma from the surgical standpoint. (Such is the author's statement and intention, though the subject of radiation appears prominently.)

In epithelioma of the oropharynx, the larger the neck glands are, the smaller is the primary growth. Early growths may be removed by diathermy. Advanced infiltrating growths necessitate the removal of the mandible (here the author suggests, somewhat contradictorily, that the use of radon seeds is the most attractive method of attack). For tumors of the

lower pharynx, laryngectomy is advised. Until recent years, radiation of lower pharyngeal tumors with successful results was almost negligible. Intrinsic carcinoma of the larynx is now best treated by radium beam.

Abstractor's note: This article appeals to me as a demonstration of a good surgeon unconsciously admitting considerable value to methods other than his own.

Q. B. CORAY, M.D.

Early Results in Cervix Carcinoma from Single and Divided Doses of Roentgen Radiation. A. N. Arneson. *South. Med. Jour.*, 31, 21-26, January, 1938.

A comparison is made of the early results of single exposures of x-rays to each of from four to six pelvic fields with the results obtained by using protracted multiple exposures. The single exposure method is found to be of little value in producing any effect upon the disease. The divided dose treatment is, therefore, recommended.

The author uses from four to six pelvic fields, 15 X 10 cm., 200 kv. p., 0.5 mm. copper filter, and gives from 200 to 400 r daily until from 1,200 to 2,000 r have been given to each portal. The smaller dose is used when there are extensive diseases and poor physical condition. In this manner from two to three threshold doses reach the diseased area, while in the single exposure method less than one threshold dose is delivered. Less than three threshold doses are relatively ineffective in controlling cervical carcinoma.

Radium therapy augments the x-ray therapy and should be given within two weeks of the completion of the x-ray treatment. Radium fails to deliver lethal tumor beyond three or four centimeters. Careful and individual planning of both radium and x-ray therapy is necessary if present clinical results are to be improved.

JOHN M. MILES, M.D.

THE COLON

Roentgen Kymography of the Normal Colon: Defecation in Man. Richard A. Rendich and Leo A. Harrington. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 173-179, August, 1938.

The authors discuss the physiology of the colon as shown by various experimental methods. They studied the act of defecation in 39 male patients having apparently normal colons and of these 15 were kymographed. The authors' preliminary conclusions are as follows:

1. The colon and rectum move downward about 12 mm. when increase of abdominal pressure occurs.
2. There is elongation and narrowing of the rectum during evacuation, with relaxation of the anal sphincter.
3. The findings suggest that colon evacuation may be stimulated reflexly from the rectum since the rectal and anal changes seem to precede the motion in the colon.

4. When propulsion is definitely advanced the contraction of segments of the lower bowel varies irregularly with inactive segments. This segmented contraction of the circular fibers is shallow and seems to resemble a systolic and diastolic phase rather than a peristaltic wave.

5. The plicae transversalis recti are probably concerned with intrinsic rectal tonus rather than an expulsive function.

The authors suggest that kymographic studies of constipation may reveal some useful information.

IRVING I. COWAN, M.D.

Cancer of the Transverse Colon of Masked Type. A. Cade and M. Milhaud. *Jour. de méd. de Lyon*, 18, 447-452, Aug. 20, 1937.

Cancer of the transverse colon offers certain diagnostic difficulties. It is less common than those of the ascending portion and sigmoid, and the symptomatology is frequently atypical or misleading. Symptoms of pseudo-hepatic type frequently mask the true picture, as in the case reported by the authors, in which a complex clinical picture and a history of malaria and dysenteric infection obscured the true diagnosis, made only at autopsy. It is in these cases that repeated, thorough, roentgenologic examination, using barium enemas, can be of utmost value in diagnosis.

S. R. BEATTY, M.D.

DOSAGE

Roentgen Caustic. G. J. van der Plaats. *Strahlentherapie*, 62, 680, 1938.

This is a preliminary report of the author's experience with near distance x-radiation (from 50 to 60 kv., 5 cm. F.S.D., no filter). The great advantage of this technic is the sharp drop of the intensity in the first few centimeters below the lesion. Tables are shown in the paper giving the depth doses for various aluminum filters and focal skin distances. Total doses which are applied according to the fractional method range anywhere from 4 to 16,000 r. A few photographs of patients before and after treatment are reproduced. The paper served as an introduction to a motion picture showing the technic of application and the response to the treatment in a series of cases.

ERNST A. POHLE, M.D., Ph.D.

A Study of Back-scatter. Edith H. Quimby, L. D. Marinelli, and J. H. Farrow. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 799-815, May, 1938.

The object of this study was to obtain accurate values for back-scatter over a wide range of qualities of radiation and to investigate the extent of errors involved in making back-scatter determinations with thimble chambers. Accordingly, parallel series of observations were made with the two chambers.

Variation of Back-scatter with Quality of Primary Beam.—When the quality of the radiation is ind. 1-1

by its half value layer in copper it is sufficient in defining the back-scatter, for, within the range from 60 to 192 kv., radiation of a definite half value layer gives the same back-scatter regardless of the voltage and filter combination.

Variation of Back-scatter with Irradiated Area.—Up to a certain point, the greater the irradiated area the greater the back-scatter, and the same applies to the hardness of the ray.

Effect of Depth of Underlying Material.—Up to a certain depth the more material there is to scatter, the greater will be the amount of scattered radiation.

No variation of back-scatter with target-skin distance is produced.

There is no great difference between the accuracy of the thimble chamber as compared to the extrapolation chamber, once the percentage of variation is established, except at the extremes of quality in either direction.

Tissue dose cannot be expressed in roentgens, and as suggested by Failla, "tissue roentgens" should be employed. This unit can be determined by the extrapolation chamber.

Charts and tables are shown for every experiment and the entire article should be read.

S. M. ATKINS, M.D.

Dosage Units and the Ionization Method. Rolf M. Sievert. *Acta Radiol.*, 18, 742-752, October, 1937.

The author discusses the use of ionization measurements in medical radiology and proves that the method, and consequently the international r, can only under certain conditions be considered accurate and suitable for dosage purposes. The chief drawback of the method lies, according to the author, in the fact that it is not proven that the biologic effects of different qualities of radiation are proportional to their ionization values in air. The differences and difficulties encountered in the measurements of the hardest gamma rays and that of ordinary x-ray radiation (100 kv. to 250 kv.) are stressed and a revision of the "International Recommendations for Radiological Units" is advocated.

ERNST A. SCHMIDT, M.D.

The Determination of the Dose in "Rotation" Irradiation. R. du Mesnil de Rochemont. *Strahlentherapie*, 63, 176, 1938.

In a previous paper (*Strahlentherapie*, 60, 648, 1937) the author related the fundamental principles of determining the dose if the patient or the tube are rotated during the exposure. In this article he gives a series of dosage curves which permit the calculation of the surface doses and those effective in the tumor very conveniently. His example is based on radiation of a half value layer in copper of 1.2 mm. for rotation at 40 cm. distance.

ERNST A. POHLE, M.D., Ph.D.

FRACTURES

Reduction of Fractures under Roentgenoscopic Control: Two Instructive Examples. H. Tillier. *Bull. et Mém. Soc. de Radiol. Méd. de France*, 26, 180-182, March, 1938.

The author presents two cases; one of fracture of the lateral condyle of the humerus with interposition of the fragment, the other of fracture of both bones of the forearm. They serve to illustrate his belief that reduction under the screen permits the more rapid and accurate restoration of the fragments to the normal position.

S. R. BEATTY, M.D.

The Base of the Skull, with Particular Reference to Fractures. William J. Mellinger. *Ann. Otol., Rhinol., and Laryngol.*, 47, 291-305, June, 1938.

A discussion of the anatomy of the base of the skull is given with particular reference to those parts that are most frequently involved by fracture. Fractures usually occur through points and lines of weakness. In the base of the skull these are across and in line with two or more foramina, along the sutures, and through the thin bony plates in the floor of the cranial fossæ. The sphenoid is the "keystone" of the skull and is situated in the line of practically all basal fractures. The floor of the anterior fossa may consist entirely of pneumatized bone, the floor of the middle fossa almost entirely, and the floor of the posterior fossa always consists partially of bone containing air cells. As a result, a basal fracture must usually be considered compound unless proven to be otherwise. Transverse fractures of the petrous pyramid usually extend through the labyrinth and seldom heal by bony union because the endochondral layer is not endowed with regenerative power. In such cases there is constant danger of intracranial involvement in the event of upper respiratory infection. The abducens nerve is very frequently involved in fractures through the middle fossa.

L. W. PAUL, M.D.

Three Cases of Injury to the Cervical Spine, Including One of Unrecognized Fracture of the Odontoid. Brillouet and A. Viel. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 234-237, April, 1938.

Three cases of fracture of the cervical spine are presented with reproductions of the roentgenographs. A case of fracture displacement of the odontoid was remarkable for the paucity of symptoms.

S. R. BEATTY, M.D.

Fracture of the Atlas in Automobile Accidents: The Value of X-ray Views for its Diagnosis. H. F. Plaut. *Jour. Am. Med. Assn.*, 110, 1892-1894, June 4, 1938.

The x-rays have made it possible to diagnose this injury during life. The atlas has no body proper; instead, the odontoid process of the axis (epistropheus) extends into the anterior part of the atlas ring.

The atlas is injured extremely seldom by direct violence except by projectiles. X-ray examination and

autopsy reveal typical sites for fractures of the atlas: the bilateral and unilateral ones in the posterior arch, where it is weakened by the groove for the artery, and those in the anterior arch. Breaks of the transverse processes and in the lateral masses are the exception.

Vertical pressure on the skull, while the cervical spine is fixed in a straight position, makes the atlas suffer the brunt, and yield, when the lateral masses are squeezed between the occipital condyles and the axis.

The technic for the demonstration of the various types is discussed in detail and illustrated.

CHARLES G. SUTHERLAND, M.D.

HEART AND VASCULAR SYSTEM

Studies of the Circulation in Pericardial Effusion. Harold J. Stewart, Norman F. Crane, and John E. Deitrick. *Am. Heart Jour.*, 16, 189-197, August, 1938.

The authors, after a study of a patient with pericardial effusion, conclude that the accumulation of fluid in the pericardial cavity of man results in: (1) marked decrease in the volume output of blood from the heart both per minute and per beat; (2) increase in the arm-to-tongue circulation time; (3) rise in venous pressure; (4) increase in intrapericardial pressure; (5) decrease of heart rate, and (6) decrease of vital capacity.

All of these abnormal conditions tend to disappear when excess pericardial fluid is removed. It appears that the decrease of cardiac output is due for the most part to interference with the inflow of blood into the right heart. It cannot be said, however, that contraction is not also impaired. Increase in the amount of pericardial fluid is associated with progressive decrease of cardiac output and rise of venous pressure. Venous pressure falls, rapidly at first and then slowly, to a normal level as fluid is removed from the pericardial cavity.

W. H. GILLENLINE, M.D.

The Significance of Left Auricular Dilatation in Auricular Fibrillation. Marcy L. Sussman and Marston T. Woodruff. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 184-188, August, 1938.

The authors studied 96 cases of chronic auricular fibrillation: 44 were classified as cases of rheumatic valvular disease and 52 cases as without rheumatic valvular disease. In the rheumatic heart group all of the patients had definite valvular disease and marked enlargement of the left auricle. In the non-rheumatic group, 22 of the 52 patients were found to have a normal-sized left auricle (seven by postmortem examination).

The roentgen method of study of left auricular size was as follows: the exposures were made in the lateral view while the patient was drinking a barium mixture and taking a deep inspiration at the instant of exposure. The left auricle was considered enlarged when there was posterior displacement of the esophagus.

This method of investigation was not considered an accurate one but the most satisfactory for this study.

The authors' conclusions are as follows:

1. The size of the left auricle was not directly related to the presence of fibrillation.
2. Where the left auricle was enlarged in the non-rheumatic group there was uniformly an accompanying congestive failure.
3. Disproportionate left auricular enlargement in the non-rheumatic group was usually to be accounted for by "mitralization" or by myocardial disease.
4. Dilatation of the left auricle in hyperthyroidism is usually associated with auricular fibrillation and congestive failure.

IRVING I. COWAN, M.D.

The Radiological Examination of the Heart. L. E. Rothstadt. *Med. Jour. Australia*, 2, 116-122, July 23, 1938.

The author presents three very fine diagnostic representations of the radiological appearance of the heart and describes the appearance of the heart in health and in some diseases. The paper contains an excellent summary of the various physical signs and correlates them with the appearance of the heart.

W. H. GILLENLINE, M.D.

HERNIA, DIAPHRAGMATIC

Diaphragmatic Hernia. E. Mendelssohn Jones. *Minnesota Med.*, 21, 402-409, June, 1938.

The author reviews the literature on diaphragmatic hernia and its classification. The symptoms resemble those of intestinal obstruction. The condition should be suspected in those patients who have had a crushing injury of the chest, and the importance of fluoroscopic examination in the horizontal and Trendelenburg positions is stressed. The condition should be suspected in cases of dextrocardia.

Five cases are presented. The first followed a bicycle injury in which the patient was thrown against the end of a handle bar. She complained of nausea and vomiting, with gastric distress which was worse always when lying down. Complete relief followed operation. The second patient complained of nausea, vomiting, and heartburn; was very obese, and had a recurrence following operation. The third patient, a woman, 63 years of age, dated her symptoms to whooping cough which she had when a child. She had consulted several physicians, and had had several courses of ulcer management, which aggravated the symptoms each time they were attempted. X-ray examination showed an extensive herniation of the pars cardia of the stomach. She was operated upon and died the second day after operation of multiple pulmonary emboli (autopsy). The fourth patient was a man, 43 years of age, who had been on management for duodenal ulcer for 21 years. X-ray study showed the presence of duodenal ulcer, and operation was done, but the colon was found herniated into the

thoracic cavity through an opening in the right side of the diaphragm four inches in length. Operation gave complete relief of symptoms. Further questioning of the patient brought out the statement that at the age of nine he had fallen from a horse, striking his right side.

It is pointed out in connection with this case that the roentgenologist's attention was so focused on the duodenal bulb during the examination that he did not note the obvious finding of a loop of colon in the thoracic cage.

The fifth patient was a man, 63 years of age, who had had an automobile accident in which three ribs on the left side had been fractured, and in which he had had an injury to his back and side. X-ray examination showed that the entire stomach, all of the jejunum, part of the ileum, and a loop of colon had passed into the left thoracic cage through a rupture in the left hemidiaphragm. Operation was done, with cure of the hernia.

An additional case was presented showing congenital diaphragmatic hernia, in which the left thoracic cavity was crowded with abdominal viscera pushing the heart and lungs to the right thoracic wall. It is readily understood that a hernia of this type is incompatible with life.

The abdominal approach was used in all the cases cited, with ethylene and ether anesthesia. In the case of the large traumatic hernia, administration was by the intratracheal method. The diaphragm was sutured with silk, together with sutures of fascia lata.

In one case of esophageal hiatus hernia the sac was removed, but in the second and third cases the stomach was freed from the hernial sac and the sac allowed to retract into the posterior mediastinum.

In obscure chest cases, thoracentesis should not be attempted until diaphragmatic hernia has been ruled out.

PERCY JOSEPH DELANO, M.D.

HERNIA, HIATAL

Hiatal Hernia. Herman J. Moersch. *Ann. Otol., Rhinol., and Laryngol.*, 47, 754-767, September, 1938.

A general review of the subject of hiatal hernia is given, based on a series of 246 cases, 64 of which were subjected to operation. Pain situated under the lower end of the sternum or high in the epigastrium is the most frequent symptom. Dysphagia was present in approximately 20 per cent of the cases. Often this was present at the outset of a meal but if the patient could belch or vomit he could then complete the meal without difficulty. Thirty-two cases gave a history of bleeding. The cause of such bleeding is not always apparent. In some a definite ulcer may be found in the hernia, usually at the site where the stomach is in contact with the hernial ring. The diagnosis is dependent primarily on roentgenologic studies but attention is directed to the value of esophagoscopy in the study of this condition. Carcinoma at the cardia may offer a great deal of diffi-

culty in diagnosis roentgenographically and the importance of esophagoscopy to avoid possible unforeseen therapeutic problems is again emphasized. One case is reported in which a foreign body (persimmon skin) became lodged in the esophagus and led to the mistaken diagnosis of tumor. After removal of the foreign body a hiatal hernia of the short esophagus type was demonstrated. The difficulty of differentiating between hernia and normal hiatal relaxation is mentioned.

The problem of treatment is dependent on the type of hernia and severity of the symptoms. The reduction in weight may afford a great deal of relief in the obese patient. Interruption of the left phrenic nerve was carried out in 13 cases with improvement in symptoms in seven. In the remainder the symptoms were aggravated. This procedure is no longer advised as it may lead to post-operative relaxation of the diaphragm with consequent danger of increased difficulty. A number of illustrations showing the various types and roentgenographic features are included

L. W. PAUL, M.D.

THE HIP JOINT

Acute Arthritis Developing in a Hip Joint Presenting the Lesions of Post-traumatic Coxarthrosis. Lamarque and Bétoulières. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 80-82, January, 1938.

The radiologic evidences of an acute suppurative arthritis are relatively late in making their appearance. These, coupled with the irregularity of contour and density residual from a previous fracture of the neck of the femur, made the radiologic diagnosis difficult in a case of pneumococcus arthritis.

S. R. BEATTY, M.D.

Deformities of the Hip Joint in Children. C. G. Teall. *Proc. Royal Soc. Med.*, 31, 935-939, June, 1938.

The author discusses roentgenographically those deformities frequently seen in a children's hospital.

The largely cartilaginous state of surrounding bone permits little direct information concerning normal appearance of the condition of the infantile hip. Ossification usually appears in the heads of the femurs in the second six months, but may do so in the first three months, or after the first year. Unilateral delay is not a fully reliable sign of abnormality. Accurately positioned views are required, including both hips on one film, and avoiding external rotation of the femurs.

Congenital dislocation may be unilateral or bilateral, complete or partial. Slight displacement is readily overlooked. Early recognition, though important, is exceptional before the child walks. A shallow sloping acetabulum, which lacks its normal horizontal buttress, is the most important sign before ossification appears in the femoral head. This ossific center may be delayed or small as compared with an opposite normal hip. The shallow acetabulum is further filled with an overgrowth of fibrous tissue and cartilage, leaving a wide joint space after reduction. A false acetabulum,

shallow or well formed, may form on the side of the ilium, in long-standing cases. Displacement may be negligible before weight-bearing, but is revealed by a break in the normal curve from the femoral neck to the pubic ramus. Films after reduction must be studied for fracture as well as for position, especially when reductions are made after a period in plaster. Apparently good reductions may fail because the acetabulum remains abnormal or because the femoral head, injured in reduction, develops poorly. Later the condition may be hard to distinguish from old osteochondritis.

The earliest sign of tuberculosis is a slight local rarefaction of bone, best seen by comparison with the opposite hip. The disease may begin in the synovia and, uncommonly, it may run its course without a recognizable lesion of bone. Usually an evident focus, not long delayed, is seen in the head or neck of the femur, or in the acetabulum. Trabeculae become ill-defined and disappear, first showing mottled rarefaction and later, an area of complete destruction. This process is generally slow but in severe cases part or all of the head and neck of the femur and the adjacent acetabulum may disappear rapidly. The joint is usually involved early, though primary foci in the neck of the femur may remain localized. With improvement, recalcification proceeds till the remaining bone reconsolidates. An almost normal-appearing joint can result only after very early arrest. Complete disorganization nearly always occurs. Sound ankylosis in good position is usually a hoped-for and satisfactory result.

Osteochondritis deformans juvenilis coxa, heralded by a limp, occurs predominantly in the male between the ages of five and ten years. Various supposed causes remain unproved. The epiphysis of the femoral head becomes flattened and dense. Its base then becomes irregular, and cavity-like decreased densities appear in the metaphysis. The epiphysis becomes denser and flatter. The weakened diaphysis broadens and the fragmented epiphysis spreads over it, resulting in gross deformity. The outer margin of the still normal acetabulum deforms the enlarged epiphysis by pressure. The broadened epiphysis consolidates and the acetabulum molds to fit it. Deformity and fair function result after a usual course of four years. Arthritic changes follow.

Acute infective arthritis is commonly secondary to sepsis elsewhere, usually from the streptococcus or pneumococcus, and especially it follows scarlet fever. The roentgenographic evidence varies with the severity. Distention widens the joint and may even cause subluxation or dislocation. Erosion of articular surface and variable destruction of bone occur. The femoral epiphysis may separate and may be destroyed. Complete disorganization and eventual ankylosis are frequent. In the infant, a primary epiphysitis secondarily involves the joint. Subluxation or dislocation are found and the epiphysis is usually completely destroyed. Ankylosis does not follow in the infant as a

rule and the end-result may resemble old congenital dislocation.

Congenital syphilis in the hip is more commonly of the osteochondritic type. The severity varies from a slight rarefaction on either side of the epiphyseal line to a gross destruction. Metaphyseal infraction may cause a so-called epiphyseal separation, as in scurvy.

Coxa vara is produced by weight-bearing on a weakened neck which may reduce its angle from a normal 160 degrees to less than 90 degrees. The origins may be:

Infantile type: a clinical entity, though attributable to causes later described. Its changes are of osteochondritic nature. It is usually bilateral, but without symmetrical degrees of involvement.

General bone disease: as rickets, achondroplasia, dyschondroplasias, particularly that type confined to hips and certain vertebral bodies.

Local disease of bone: as tuberculosis, osteochondritis juvenilis, and osteomyelitis.

Slipping femoral epiphysis: an adolescent type of slip (between the ages of 10 and 15 years) is presumably due to trauma plus osteochondritis. The cause is not fully understood but is not purely trauma. The displacement varies from a slight one to one in which the metaphysis rests upon the acetabulum. The epiphysis appears normal, but the diaphysis may appear abnormal. Early reduction may give good function. Inadequate treatment results in gross deformity, necessitating osteotomy. Epiphyseal slip may follow definite local disease, such as osteomyelitis, septic arthritis, or renal rickets.

Coxa valga may appear in instances in which the femur has not borne weight as in unreduced congenital dislocation, progeria, and fragilitas osseum.

RAY A. CARTER, M.D.

Traumatic Dislocation of the Hip Followed by Perthes' Disease. Raphael R. Goldenberg. *Jour. Bone and Joint Surg.*, 20, 770-774, July, 1938.

Perthes' disease following traumatic dislocation of the hip is demonstrated by a case report. The onset was thirteen months after the dislocation. No evidence of deformity of the femoral head was apparent at the time of dislocation or shortly thereafter. Previous reports of the association are mentioned.

J. B. McANENY M.D.

INFECTION

Radiation Therapy of Fungus Infections. Davis Spangler. *Texas St. Jour. Med.*, 34, 289-291, August, 1938.

Yeasts and fungi are constantly present in the mouth and often on the skin. They usually gain entrance to the body through some wound. The morbid changes are those of chronic suppuration, tissue destruction, and the formation of granulation tissue. No tissue of the body serves as an effective barrier. The diagnosis is usually tumor or abscess.

Persistent and thorough radiation is more effective

than either potassium iodide or surgery. Small lesions are given from 1,000 to 3,000 mg.-hr. of radium. Extensive or deep-seated lesions are given from 1,500 to 3,000 r units of x-ray to the diseased area in daily doses of from 200 to 250 r, repeated each 6 to 12 weeks until all evidence of the infection has disappeared. Several cases are reported.

JOHN M. MILES, M.D.

Radiation Therapy of Infections. Harold G. Reineke. *Jour. Med.*, 19, 463-465, November, 1938.

Reineke diverts attention from the common belief that only malignant conditions are treated with x-rays, and stresses several common infectious processes that respond well to radiation.

The rationale of irradiation is not known but it has been shown that almost immediately following exposure to x-rays the leukocytic infiltration is affected, in that these cells begin to disintegrate. This is followed closely by relief of pain and the beginning of spontaneous resolution. It is believed that the disintegration of the leukocytes liberates protective elements which counteract the effect of the invading organism.

The dosage is moderate in range; the more acute the lesion, the lower the dosage, and the less acute, the higher the dosage. The pathology determines the proper dosage.

Among the infectious processes favorably affected by irradiation are furuncle, carbuncle, abscess, cellulitis, acute adenitis, erysipelas, otitis, mastoiditis, osteomyelitis, and gas bacillus infection.

J. B. McANENY, M.D.

THE INTESTINES

Regional Enteritis. James V. Prouty. *Jour. Iowa St. Med. Soc.*, 28, 379-382, August, 1938.

Regional enteritis may be encountered in an acute or a chronic form. The lesions are not confined to the terminal ileum but may involve one or more areas of the jejunum, ileum, or colon with the same pathological findings but with varying clinical manifestations. The etiology is unknown. There is no definite clinical picture since the symptoms depend upon the severity, location, and extent of the disease. In acute cases the symptoms are those of an acute abdominal process and the diagnosis of acute appendicitis often is made. In chronic cases, weight loss, secondary anemia, and symptoms of partial intestinal obstruction are prominent. If confined to the colon, the symptoms are those of ulcerative colitis. In early cases the only roentgenological signs may be a persistent irritability and lack of filling of the involved segment with hypomotility of the proximal bowel. Some swelling and flattening of the mucosal pattern may be seen or the mucosa may have a polypoid appearance. Later the wall is thickened and less pliable than normal. If there is ulceration, the walls are jagged and irregular. In advanced cases the lumen becomes narrow and cord-

like. When there is an ileo-colitis the findings are similar to tuberculosis and it is doubtful if differentiation could be made were it not for associated tuberculous lesions elsewhere in the body. When the disease involves only the colon it usually is the proximal portion that is involved. The ultimate prognosis is uncertain and medical treatment has little curative value, treatment being essentially surgical.

L. W. PAUL, M.D.

Problems Presented by Lesions of the Right Quadrant. Otto C. Pickhardt and Henry A. Rafsky. *Jour. Am. Med. Assn.*, 109, 2048-2053, Dec. 18, 1937.

Every so often patients with a disease condition in the right lower quadrant are encountered who not only have run the gamut of diagnostic procedures for years, but who also have undergone surgical intervention only to have a questionably diseased appendix removed.

In the diagnosis of lesions of the right lower quadrant one must remember that the anatomic relationship of the viscera is such that the symptoms referable to this area may be due to lesions elsewhere in the body and that, conversely, general abdominal complaints or pain in the lumbar and sacral regions may be due to a pathologic process in the right iliac fossa. Lesions of the right lower quadrant are not infrequently associated with other abdominal diseases or systemic infections.

The authors stress the necessity of a careful roentgen study of the small bowel, and report a series of cases in which studies were valuable in the establishment of the diagnosis.

CHARLES G. SUTHERLAND, M.D.

Diagnosis of Chronic Intestinal Amebiasis. Marcel Poirot. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 44-48, January, 1938.

Since the World War the incidence of amebiasis in France has increased and must be suspected in cases with evidence of colitis. There are no diagnostic radiologic findings but there are three characteristic findings: a scalloped appearance of the silhouette of the colon, a ribbon-like appearance, and a rigid tubular colon corresponding to the three chief stages of the disease. Reliance for diagnosis must be placed chiefly in microscopic study of mucus and discharge from the base of the ulcers, which should be obtained before preparation of the colon by enemas.

S. R. BEATTY, M.D.

THE KIDNEYS

A Syndrome Consisting of Affections of the Kidney, Stunted Growth, Rickets, and Disturbed Cystine Metabolism. G. O. E. Lignac. *Am. Jour. Med. Sci.*, 196, 542-547, October, 1938.

The above-described syndrome has been met with in seven cases and is considered a definite entity. Infantile and juvenile forms are distinguishable. The acute renal changes in this disease separate it from renal rickets. The disturbed cystine metabolism, dis-

coverable only at autopsy, may be due to inability to assimilate this amino acid, with subsequent deposition in, and damage to, the organs, especially the kidneys, or to failure of excretion by the kidneys.

BENJAMIN COPLEMAN, M.D.

Perirenal Fibrosarcoma. Herbert H. Howard and Howard I. Suby. *Jour. Urol.*, 40, 491-501, October, 1938.

A case of perirenal fibrosarcoma is reported. A pre-operative diagnosis of a large tumor of the left kidney was made and a large mass was removed through a right rectus incision. High x-ray therapy was started post-operatively, but the patient died in eight months.

The authors recommend immediate extensive x-ray therapy. They are of the opinion that surgery offers nothing in these cases.

JOHN G. MENVILLE, M.D.

Late Results in the Conservative Management of Nephrolithiasis. James T. Priestley and William F. Braasch. *Jour. Am. Med. Assn.*, 109, 1703-1705, Nov. 20, 1937.

Operation is usually advised and performed if a patient is found to have a renal calculus. For various reasons, however, certain persons who have nephrolithiasis are not treated surgically at the time when the diagnosis is first established. The minute nature of the calculus, the complete absence of symptoms, the presence of serious disease elsewhere in the body, advanced pathologic changes in the urinary tract, and other reasons may apparently render operation unnecessary or undesirable. Some patients who are not operated on progress quite satisfactorily under medical management and no serious symptoms referable to the urinary tract develop. Unfortunately, this is not generally true, as in the majority of cases symptoms of varying severity occur sooner or later and may render subsequent operation imperative, or even jeopardize the patient's life. A follow-up study was made of 177 patients who had nephrolithiasis but were not operated on at the time when the stones were first discovered.

In general it was evident that surgical treatment should be advised for primary calculi unless they were so minute that they might pass spontaneously. The absence of pain or urgent symptoms is no excuse for advising against operation. If the stone is not removed, renal damage is progressive to a greater or less extent in the majority of cases and operation often ultimately becomes imperative. If operation is postponed until this time, the chance for performing a conservative operation and preserving the kidney is certainly reduced. If, for any reason, a given stone is not removed soon after its presence is detected, the importance of careful periodic urologic examination cannot be overestimated. Under close observation of this type it may occasionally be safe to treat certain patients with nephrolithiasis medically. Changes in the size of the stone, the pyelographic observations, renal function, and other important factors

can then be detected early and the proper treatment can be instituted before the kidney has been too severely damaged. Excretory urography will usually supply the pertinent data in such cases.

Although many of the patients who had large, bilateral branched calculi survived some years without evidence of serious difficulty, in almost every case the symptoms developed sooner or later, and very few of them were living ten years after the stones were first discovered. In some cases small calculi associated with large branched stones became dislodged and occluded the ureter. Damage to the renal parenchyma was progressive, so that ultimately the renal reserve was greatly depleted and operation or any intercurrent demand on renal function carried a very high risk. Destruction of the kidneys was often slow and during the ensuing years the patient may have enjoyed comparative comfort while resting under a sense of false security.

With the current improvements in surgical procedures and post-operative treatment the risk of operation in cases of this type has been definitely reduced and the chance of preserving a functioning kidney correspondingly enhanced. Obviously, if operation is to be performed, the optimal time is prior to the development of renal insufficiency.

CHARLES G. SUTHERLAND, M.D.

Roentgenologic Demonstration of a Papilloma of the Kidney Pelvis. Hans Keilhack. *Röntgenpraxis*, 10, 669-671, October, 1938.

Primary tumors of the kidney pelvis are rather uncommon. Their roentgenologic demonstration is based on irregular contours in the filling of the kidney pelvis by contrast material or by an eccentric dilatation of the kidney pelvis.

The author describes a case of a benign papilloma of the kidney pelvis, demonstrated by a retrograde pyelogram and proved by autopsy. The right kidney pelvis was markedly dilated and there was an intrinsic smooth filling defect the size of a walnut. Because of the death of the patient from a brain hemorrhage it was thought to be a malignant tumor with brain metastases, but autopsy showed it to be a benign papilloma.

HANS W. HEFKE, M.D.

KYMOGRAPHY

Roentgen Kymographic Studies of Aneurysms and Mediastinal Tumors. Wendell G. Scott and Sherwood Moore. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 165-172, August, 1938.

The history of roentgen kymography is briefly summarized and a description of the kymograph is given.

The authors state that since the film is a graphic record of physiological movements of the heart and great vessels, kymography is applicable in differentiating between aneurysms and intrathoracic tumors. Aneurysms, ordinarily, produce movements over their borders while tumors do not.

By the use of the kymograph a differentiation is made between expansile and transmitted pulsations. If the movement is expansile, both sides of an aneurysm will move outward from the mass at the same moment, and medially at the same time. The diameter of the mass increases at systole and shortens at diastole. This finding strongly supports the diagnosis of aneurysm. If the movement is transmitted, both borders of the mass shift in the same direction at the same time, and the diameter of the mass remains constant. Diagrams of these movements are shown. For such a study, it is necessary to place the kymograph so that both sides of the tumor are recorded through the same slit. The change in density of a mass during systole and diastole is another aid in differentiating between aneurysm and neoplasm. Kymographs also possess a Potter-Bucky grid effect which permits better visualization of the course of the thoracic aorta with respect to adjacent masses.

The limitations of this method of examination are stated, and illustrative cases are cited. The authors conclude that the method is a valuable one but cannot be employed successfully in all cases because: (1) large, thick-walled aneurysms with laminated blood clots may not record motion; (2) tumors in close apposition to the heart and great vessels may show transmitted movement at their borders, and (3) an extremely vascular tumor may show expansile motion, although this is rare.

IRVING I. COWAN, M.D.

THE LUNGS

Pulmonary Pneumocyst: Report of an Enormous Solitary Cyst in a Healthy Adult Female. Garnett Cheney and L. Henry Garland. *Am. Jour. Med. Sci.*, 196, 699-703, November, 1938.

A case of a giant pulmonary cyst displacing the heart and mediastinum to the opposite side is reported. An abnormal condition of the involved lung was discovered by x-ray examination 17 years previously. Despite a vital capacity only 27 per cent of the expected normal, the patient suffered no complaints, even after violent exercise.

BENJAMIN COPLEMAN, M.D.

Massive Atelectasis Following Cyclopropane Anesthesia: Report of Cases and a Theory of Cause and Prevention. Oswald R. Jones and George E. Burford. *Jour. Am. Med. Assn.*, 110, 1092-1095, April 2, 1938.

This is a report of cases and a theory of cause and prevention. Autopsy, when preformed in cases coming to the authors' attention, showed massive atelectasis of one or both lungs.

The circumstance producing complete atelectasis of a whole lobe has of recent years been assumed to be obstruction in the main bronchus followed by absorption of the alveolar gases behind the obstruction. When the obstruction becomes effective, the time required for development of atelectasis depends on the rate of absorption by the lung of the gases distal to the obstruc-

tion, provided the circulation in the lung is intact and the alveolar epithelium undamaged.

It was shown that great variation exists in the rate of this absorption. Anesthetic gases were absorbed in a matter of minutes, the inert gases nitrogen, hydrogen, and helium required from 18 to 26 hours for absorption, which even then, for helium, was not complete. Reviewing the time required for a comparable degree of absorption of 600 c.c. of gas by the lungs of dogs, the great rapidity of absorption of the anesthetic and active gases as compared with the inert "filler" gases was emphasized. It was observed under direct vision, after blocking the bronchus, that a specific degree of atelectasis appeared after the varying intervals stated for the different gases. Toward the end of an operation the patient may be breathing an atmosphere made up almost entirely of rapidly absorbable gases, the inert gases having been lost during the anesthesia. When the alveoli of the lungs have lost the supporting properties of the inert gas nitrogen, conditions are present which favor atelectasis. Patches of atelectasis may develop without an obstruction in any portion of the bronchial tree; this creeping atelectasis could go on until an entire lobe was involved. The first indication of it would appear when the mask was removed at the end of the operation.

The obvious remedy is to add inert gas to the cyclopropane mixture.

The most useful addition to the cyclopropane atmosphere or other anesthetic atmospheres should be either hydrogen or helium, the latter—being light and inert and not explosive—seems at this time to be the best substitute for nitrogen in the replacement of that very necessary supporting gas in the pulmonary alveoli.

CHARLES G. SUTHERLAND, M.D.

The Value of Radiology in the Elucidation of Hemoptysis. Franklin G. Wood. *British Med. Jour.*, 2, 211-213, July 30, 1938.

The author opens his article with a statement that hemoptysis may be a symptom of any acute lung disease. Roentgenographs should be made in all cases in which tuberculosis is suspected. Oblique and lateral positions as well as the usual post-anterior and anteroposterior should be made. Non-tuberculous conditions are discussed as follows:

Bronchiectasis.—In cases in which it is suspected, lipiodol should be used to demonstrate cavities. The oral method of injection is best.

Heart Disease.—Hemoptysis is an important symptom in mitral stenosis. Roentgenography is a great help as it shows typical heart outline and lung congestion. Kymography is proving to be of considerable use.

Bronchial Carcinoma.—Frank hemoptysis is uncommon but lung changes can be seen in the roentgenograph.

Aneurysm of Aorta.—Differential diagnosis from growth or tumor must be made, although it is sometimes difficult. The kymograph is of great assistance here.

Hemoptysis sometimes follows chest trauma even when no rib fracture can be demonstrated. It is well known that no examination of the chest is considered complete to-day without thorough roentgenographic investigation.

Q. B. CORAY, M.D.

Radiation Therapy in Primary Neoplasms of the Lung. Ralph E. Myers. *South. Med. Jour.*, 31, 275-286, May, 1938.

Six cases are reported, one of which, microscopically proved carcinoma, is living and well five years after the first course of roentgen therapy. Intensive radiation was used.

Radiation changes in the lung may render it a weak spot and so lower its resistance as to make it especially susceptible to infection. In two heavily irradiated patients, abscesses formed in the irradiated portion of the lung.

JOHN M. MILES, M.D.

Acute and Chronic Atelectases of the Lungs and Their Sequences. Rudolf Pohl. *Röntgenpraxis*, 10, 651-659, October, 1938.

If the alveoli of one part of the lung are without air and there is no evidence of inflammatory changes, one calls these findings an atelectasis. An occlusion or a narrowing of the bronchus supplying a certain area is of greatest importance for the occurrence of an atelectasis, for instance: swelling of the mucosa, secretion, blood clots, glands, tumors, foreign bodies, etc. But there are other types of atelectasis in which a bronchial obstruction cannot be found, the so-called idiopathic or dynamic atelectasis. Roentgen studies of the lungs have added much to the diagnosis of atelectasis.

The author describes in detail seven cases which were proved either by their course or by autopsy.

Enlarged hilar glands, often tuberculous, may cause an acute atelectasis which disappears completely in a relatively short time, sometimes in 24 hours. This type of atelectasis is most often seen in children.

Two cases are described in which such bronchial occlusion took place in adults, both on the basis of tuberculosis of the hilar glands. In one case bronchioliths, probably arising from calcified glands, led to attacks of bronchial obstruction and atelectasis relieved the obstruction by coughing up the calcified material.

If the process which causes the atelectasis persists for a certain time the involved lung exhibits evidence of a chronic atelectasis. That portion of the lung is shrunk and the lung tissue shows signs of chronic induration with secondary inflammatory changes, bronchiectases, and central abscesses. Mediastinitis and pleuritic involvement often accompany this type.

The chronic atelectasis is seen in a typical fashion in the bronchogenic carcinomas. Such cases are described herein. Hodgkin's disease, aneurysm, gumma, and other lesions may lead to an atelectasis.

A case of a dermoid cyst of the lung is quoted. The diagnosis was obscure for many years, because the

cyst was hidden by the chronic atelectasis. A bronchogram made the diagnosis and surgery proved it.

In all cases of atelectasis of the lungs not only must the correct diagnosis be made, but an effort must be made to find the etiologic factor causing the atelectasis.

HANS W. HFFKE, M.D.

Primary Carcinoma of the Lung: A Clinical Study of 160 Cases in Five Years. Aaron Arkin. *Jour. Kans. Med. Soc.*, 39, 369-372, September, 1938.

During the past five years the author has seen 160 cases of primary cancer of the lung. He is convinced that this is one of the most frequent chronic pulmonary diseases in persons past 40 years of age. It must always be considered in cases of lung atelectasis, abscess, recurrent pneumonia, hemorrhagic pleurisy, empyema, or chronic pneumonia. Pain in the chest or other parts of the body, a cough and bloody expectoration, and sooner or later dyspnea, and loss of weight are the cardinal symptoms. However, it is pointed out that the symptoms are extremely variable and in about 50 per cent of the author's cases the signs and symptoms were predominately outside the lungs and due to metastases. Secondary involvement of the osseous system was present in 14 per cent of the cases and this formed the largest group with extra-pulmonary symptoms. After this, in the order of frequency, were cerebral, 10 per cent; cardiac, 8 per cent; gastrointestinal, 8 per cent; lymphoglandular, 6 per cent, and hepatic, 3 per cent. The use of roentgen rays in diagnosis is stressed.

L. W. PAUL, M.D.

The Necessity for Repeated Roentgen Investigation in Late Manifestations of Tuberculous Bronchogenic Dissemination. H. Bartsch and S. Zollner. *München. med. Wchnschr.*, 85, 1078-1080, July 15, 1938.

An obscure case, having as its basis the late manifestations of a tuberculous bronchogenic dissemination, is reported to illustrate the need for repeated roentgenograms to clear up the diagnosis.

LEWIS G. JACOBS, M.D.

The Roentgen Image of Encapsulated Left Diaphragmatic Pleurisy. H. Morr. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 58, 66-76, 1938.

In criticism of a paper on this subject by L. Daniello (previously published in the same journal, 56, 541-584, October, 1937), the author postulates for the diagnosis of encapsulated exudative diaphragmatic pleurisy:

1. Band-like shadows superseding the diaphragm and able to be differentiated from the latter and from subphrenic accumulations of gas.

2. It must be shown by serial examinations that the shadow, assumed to represent such exudate, diminishes continually during aspiration and is replaceable by air—under identical technical conditions of exposure, of course.

3. Relationship of the band-like shadows to a

tempt to correlate the roentgen appearance with the acceptable treatment. Perforation and pyloric stenosis are absolute indications for surgery, and produce typical films. Suspicion of malignant change, as manifested by enlargement of the crater under treatment, is also a surgical indication. Failure of a benign ulcer to decrease under therapy should in any case lead one to consider surgery. The mere existence of marked roentgenological alterations should not, however, be made the sole grounds for surgical intervention. Among the conditions which offer a challenge to operative intervention are the hour-glass stomach, outspoken delay in emptying, high grade involvement of the lesser curvature, leather-bottle stomach, and advanced scarring of the cap. Bleeding is often an indication for surgery. Evaluation of symptoms and social status is often important. Surgical contra-indications are noted. The article is well illustrated.

LEWIS G. JACOBS, M.D.

PNEUMONIA

Resolving Lobar Pneumonia in Adults Simulating Tuberculosis in the Roentgenogram. Samuel Cohen. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 202-214, August, 1938.

The author reviews 10 cases of resolving pneumonia in adults who were erroneously suspected of having tuberculosis. Five of the cases were presented with serial roentgenographic studies. He emphasizes the value of serial roentgenograms taken at short intervals. In addition, the history and entire clinical course should be studied, including repeated sputum examinations and tuberculin tests.

From a roentgenologic standpoint the differentiation between resolving lobar pneumonia and tuberculosis is based on two factors: (1) the time interval for resolution of the pulmonary process (in lobar pneumonia the clearing of the infiltration is comparatively rapid, while the slow rate of resolution of tuberculous lesions is characteristic), and (2) the absence of a residue of the pulmonary infection as resolution is completed. The latter is more characteristic of lobar pneumonia. Cases of delayed resolution in lobar pneumonia, particularly when present in the upper lobe, are more difficult to differentiate roentgenologically. All factors which may retard the healing of a pneumonic process should be considered.

IRVING I. COWAN, M.D.

Delayed Resolution in Bronchopneumonia. F. N. Cole. *Jour. Iowa St. Med. Soc.*, 28, 389-392, August, 1938.

Delayed resolution in bronchopneumonia is not a clear-cut clinical entity and some do not believe that such a condition exists. The author is of the opinion that it is largely a matter of definition. The diagnosis is based on the following points: (1) A history of a preceding bronchopneumonia. (2) Persistence of symptoms after the acute condition has passed. (3)

Physical findings of consolidation. (4) X-ray evidence of increased density in the lung. (5) Exclusion of other known conditions.

The differential diagnosis includes: (1) tuberculosis; (2) empyema; (3) pleurisy with effusion; (4) lung abscess; (5) malignancy of the lung; (6) spontaneous pneumothorax; (7) bronchiectasis; (8) fungus infections; (9) syphilis; (10) foreign body; (11) Reissman's pneumonia; (12) lipoid pneumonia in infants, and (13) atelectasis due to plugging of a bronchus or bronchiole by exudate or swelling. The author believes that this latter condition is probably what is present in most of the cases which do not fall into any of the above categories.

Bronchoscopic examination with the removal of any obstructing material will effect a cure. The prognosis usually is good except in the very old or very young.

L. W. PAUL, M.D.

Tuberculous Pneumonia. J. W. Strayer. *Jour. Indiana St. Med. Assn.*, 31, 605-608, Nov. 1, 1938.

The deposition of a large number of tubercle bacilli in high concentration on allergic tissue forms the pathogenesis of this condition. In the lobar type the lesion is usually in an upper lobe and massive caseation appears in from one to two weeks; cavity formation usually takes place early.

In the acute bronchopneumonic form the disease may be limited to a few lobules or may involve both lungs. It closely resembles non-tuberculous pneumonia until caseation occurs. Large soft tracheo-bronchial nodes are a constant finding and their rupture may be the cause of the dissemination.

The clinical course resembles non-tuberculous pneumonia except that resolution does not take place as expected, but is prolonged.

The x-ray film usually shows an upper lobe involved and occasionally a cavity. Pleural thickening at the periphery or at the interlobar fissure usually speaks for tuberculosis. The prognosis depends upon the extent of the disease, the resistance of the patient, and his proper care. The course is long. Several excellent roentgenographs are presented.

J. B. McANENY, M.D.

Roentgen Therapy of Lobar Pneumonia. Eugene V. Powell. *Jour. Am. Med. Assn.*, 110, 19-22, Jan. 1, 1938.

The author reports the results of roentgen radiation in 104 cases of acute lobar pneumonia and in 30 cases of bronchopneumonia.

It was soon noted that patients who had received roentgen therapy were generally relieved of much of their respiratory and circulatory distress, occasionally within 30 minutes, but more often within two to three hours.

The technic is 250 to 350 roentgens of 0.3 Ångstrom unit of effective radiation (135 kv. with 3 mm. alumi-

num filter) given anteriorly or posteriorly over an area a little larger than the involved portion of the lung. If the temperature and white blood cell count have not dropped to normal within 36 to 48 hours, a second roentgen treatment is given to an opposite field. It is only when the leukocyte count remains high, or when temperature remains elevated, that the additional treatment is given. A few patients with pneumonia of mixed infection received a third or fourth treatment.

Bronchopneumonia seemed to be more variable and as a whole less favorably influenced than lobar pneumonia. Patients with bronchopneumonia, treated during the first three or four days with diathermy and then given roentgen therapy, responded well, in the experience of others.

The author found that patients with lobar pneumonia treated with roentgen rays during the stage of congestion recovered more slowly.

Patients with a mixed infection frequently showed a prompt response followed by a secondary rise in temperature a few days later. After a second or third roentgen treatment these patients generally returned to normal and remained normal.

CHARLES G. SUTHERLAND, M.D.

RADIUM

How is Soluble Radium, Injected into an Animal, Distributed in the Various Body Tissues? F. Daels, H. Fajerman, and van de Putte Van Hove. *Strahlentherapie*, 63, 545, 1938.

The authors injected normal mice, normal white rats, and guinea pigs, including pregnant animals and also some with a sarcoma, with soluble radium solutions containing up to 0.06 mg. element. To determine the radium content of the various dried or embedded tissues, the film method was used. The exposure time varied from one week to three months. Most of the radium was found in the liver, kidneys, lungs, and bone marrow. Placenta and embryo also contained radium. Sarcomatous tissue did not retain radium in a higher degree while muscles and brain tissue contained hardly any radium.

ERNST A. POHLE, M.D., Ph.D.

The Experimental Production of Sarcoma with Radium and Mesothorium. E. Uehlinger and O. Schürch. *Schweiz. med. Wchnschr.*, 68, 860, 861, July 16, 1938.

The authors found that by placing a mixture of either mesothorium or radium (0.002–0.005 mg.) and vaseline (0.2 g.) in the marrow cavity of the femur of rabbits, they could produce sarcomas, either of the osseous or marrow structures, in from 57 to 63 per cent of the animals. The tumors were entirely similar to spontaneous human tumors. There was a latent period of 18 months or more in which no case of carcinoma was produced. Analogous doses of radium and mesothorium produced similar results, and since the two differ in the presence of alpha rays in radium

radiation and their absence in mesothorium radiation, the conclusion is drawn that the carcinogenic rays are the beta rays—not the alpha rays as thought by Martland.

Brief mention is made of the case of a 48-year-old man who was treated from 14 to 18 years previously with heavy doses of radium and x-ray to the sella turcica for an eosinophil adenoma of the hypophysis with acromegalic symptoms, and who came to them with a sarcoma of the ethmoid bone. The possibility of a relationship between the treatment and the tumor is noted, and the danger of such late reactions to irradiation is pointed out.

LEWIS G. JACOBS, M.D.

Radium Therapy of Carcinoma of the Skin and Lip. J. Körbler. *Strahlentherapie*, 62, 507, 1938.

The author relates his experiences with radium in the treatment of skin and lip cancer. For very superficial tumors he used contact applicators while others are treated at a distance of 1 cm. If the lesion is not too close to the bone, he prefers the implantation of radium needles. The time of application varies from 72 to 120 hours, while the amount of radium is determined by the size of the lesion. The results are compiled in four tables, reviewing the material after a three- and a five-year observation period, respectively. They include all stages of the disease. Out of a total of 357 cases, 26 could not be traced, 51 died from carcinoma, 20 from other causes, 20 developed recurrence, and 240 were well at the end of three years. The number of survivals out of 127 cases observed for five years was 63. Out of 148 lip cases followed for three years, 81 were well at the end of that period, three could not be traced, 52 had died from the cancer, nine from other causes, and three had a recurrence. Of 53 patients who could be followed for five years, 21 remained well at the end of that period. In carcinoma of the lower lip removal of the cervical lymph glands is advised.

ERNST A. POHLE, M.D., Ph.D.

The Significance of Primary and Secondary Beta Rays in Radium Therapy. W. Minder. *Strahlentherapie*, 62, 601, 1938.

Since all radium preparations send out beta and gamma rays the author investigated their proportion for various filtrations by mathematical and experimental methods. Both primary and secondary beta rays of a radium applicator can be neglected if the radium does not come in contact with the tissue; in other words, if an absorbing layer of from 0.5 to 1.0 cm. thickness (specific gravity = 1) is interposed. If, however, for instance, a radon seed with a wall filter of 0.1 mm. Pt is inserted into tissue, the effect of the primary beta rays is from four to six times that of the gamma rays. The drop of this effect with increasing distance from the source of the radiation is great. For higher filters as, for instance, 0.5 and 1.0 mm. Pt the effect of the radium applicator on the sur-

face is increased due to secondary beta rays by 128 per cent for 0.5 mm. Pt and by 90 per cent for 1.0 mm. Pt. The author also points out that this has to be considered when using the photographic method of Holthusen for the calibration of radium preparations. The films used for the dosage measurements must never be exposed to the secondary beta rays of the filter because this might lead to errors of 100 per cent.

ERNST A. POHLE, M.D., Ph.D.

ROENTGEN-RAY THERAPY

The Scope of Radiotherapy. H. H. Navid. *South African Med. Jour.*, 12, 321-323, May 14, 1938.

The author evaluates the therapeutic possibilities and results of radium and x-ray therapy in carcinoma of the cervix, the breast, and the prostate; in lymphadenoma, leukemia, and in metastatic tumor invasion. Only radiologists with adequate equipment and experience should attempt to do radiotherapy.

ERNST A. SCHMIDT, M.D.

The Technic of Roentgen Therapy of Curved Surfaces. A. Proppe. *Strahlentherapie*, 62, 109, 1938.

This is a mathematical study of the problem of irradiating curved and irregular surfaces. Several graphs shown in the article permit the calculation of the proper F. S. D., at the same time avoiding the overlapping of neighboring fields.

ERNST A. POHLE, M.D., Ph.D.

Radiation Therapy in Gynecology. Subodh Mitra. *Jour. Indian Med. Assn.*, 7, 404-407, April, 1938.

The author discusses the application of radiotherapy in the more common gynecologic conditions and stresses the desirability of radiologic training for the gynecologist and of gynecologic experience for the radiologist.

ERNST A. SCHMIDT, M.D.

SILICOSIS

Roentgenographic Studies of the Excretion of Dusts from the Lungs. A. E. Barclay, K. J. Franklin, and R. G. Macbeth. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 673-686, May, 1938.

Insufflation of various dusts of the opaque variety into the lungs of cats failed to reach the alveoli and the dust was excreted from within a few hours to three days. When the same dusts were suspended in liquids the alveoli were reached and massive collapse resulted and progressed even after most of the initiating agent was excreted. The ciliated epithelium appears to be able to arrest dry but not liquid dust.

S. M. ATKINS, M.D.

A Study of Silicosis. Philip B. Matz. *Am. Jour. Med. Sci.*, 196, 548-559, October, 1938.

Persons engaged in dusty occupations, in which

there is a silicotic hazard, in the manufacturing and mechanical industries alone, number 1,200,000. The seriousness of silicosis, which now constitutes the greatest single industrial hazard, is due to the fact that tuberculosis is a very frequent complication.

In a group of 167 silicotic veterans, the majority acquired the disease before the age of 40. The extrinsic factors, such as the type of silica dust, its concentration, length of exposure, and certain intrinsic factors, such as the rate of nodule formation and the presence of pre-existing tuberculous or non-tuberculous infection, which alter the prognosis markedly, influence the duration of the disease.

The cases were divided, according to Sampson's classification, into first, second, and third degree silicosis. The classification depended on the following: the size of the nodules; conglomerate silicosis; silicosis with tuberculosis, in which the two diseases exist as more or less separate entities; silico-tuberculosis, in which one disease cannot be separated from the other, and asbestosis. Over half of these cases showed evidence of tuberculous infection, most of which were classified as being moderately or far advanced.

Cardiovascular disease was the next most frequent complication. The changes were those of progressive dilatation and hypertrophy, secondary to obstruction of the lesser circulation.

Other complicating infections, such as pneumonia, bronchiectasis, and lung abscess were frequently found. Chronic pleurisy was usually found to be due to a complicating infection.

BENJAMIN COLEMAN, M.D.

THE SINUSES

Pneumatization of the Facial Bones in Crouzon's Disease, Apert's Disease, and Oxycephaly. P. de Gunten. *Schweiz. med. Wchnschr.*, 68, 268-270, March 12, 1938.

Thirteen cases of congenital dysostosis of the skull were studied to determine the development of the accessory nasal sinus. Crouzon's disease, characterized by craniofacial dysostosis and exophthalmos, Apert's disease, characterized by craniofacial dysostosis and syndactylia, and oxycephaly were the diagnoses. The author finds no changes in the development of the sphenoid, ethmoid, or maxillary sinus. The frontals are very variable and often absent. There is no evidence that there is any change in development of the sinus due to the osseous dystrophy, and conversely there is no diagnostic value in studies of the sinus to differentiate the type of dystrophy.

L. G. JACOBS, M.D.

Osteoma of the Maxillary Sinus. A. G. Rawlins. *Ann. Otol., Rhinol., and Laryngol.*, 47, 735-753, September, 1938.

Osteoma of the maxillary sinus is a very rare tumor, the total number of cases reported to date being 29. The author discusses in considerable detail the theories as to origin, anatomy and histology, signs, symptoms,

and diagnosis. Osteomas usually develop during the growth period of facial bones. Trauma is a factor in some cases as is shown by one of those reported by the author. The diagnosis can usually be made from the roentgenographic appearance which is similar to that of osteoma elsewhere. The treatment is always surgical and the pedicle and surrounding bone should be removed. The article contains the reproductions of three roentgenograms and has appended a bibliography of 67 references. Brief abstracts of the 27 cases previously reported are given.

L. W. PAUL, M.D.

The Diagnosis of Diseases of the Accessory Nasal Sinuses by Roentgen Study. Ludwig Stehr. München. med. Wchnschr., 85, 1189-1195, Aug. 5, 1938.

This is a general discussion of the implications of rhinologic disease, the clinical diagnosis, and the roentgen diagnosis, upon which much emphasis is placed. The use of standard positions is emphasized, with extra views in selected cases only. Skull fracture and inflammatory diseases receive chief attention to the exclusion of neoplasms. Some comments on the relation of infected teeth to antral disease are made.

LEWIS G. JACOBS, M.D.

Roentgen Therapy of Sinusitis. L. Popp. Strahlen-therapie, 63, 399, 1938.

During the last seven years the author has treated 25 patients with acute sinusitis and 18 with chronic sinusitis. In the acute type he applied 100 r per sitting at intervals of two days up to 600 r. In the chronic cases the single dose amounted to 200 r up to total doses of from 1,000 to 1,400 r, also given at intervals of two days. In all acute cases the treatment resulted in clinical cure. Ten of the chronic cases that had never been operated upon responded satisfactorily: six were cured and four improved. The remaining eight cases with chronic sinusitis had previously had several operations: six were cured and two improved. The author recommends, therefore, roentgen therapy of acute and chronic sinusitis, since he was able to obtain good results even in chronic cases in which surgical treatment had been unsuccessful.

ERNST A. POHLE, M.D., Ph.D.

THE SKULL

An Unusual Head Injury. Charles K. Fuller. Canad. Med. Assn. Jour., 39, 61-63, July, 1938.

The author reports a case of skull fracture occurring in a man 49 years of age, who, at the time of injury, did not lose consciousness and did not vomit. Five weeks after the accident the patient complained of a moderate headache and loss of bladder and bowel control. The only deviation from normal in the other systems was a slowness of mental response. An x-ray film of the skull, taken at this time, revealed a fracture of the roof of the left orbit and posterior wall of the frontal sinus with a fragment of bone penetrating the

frontal lobe of the brain and the left lateral ventricle. This fragment formed a connection between the cavity of the frontal sinus and the ventricle, acting as a valve. The ventricular system was pumped completely full of air, displacing all the cerebrospinal fluid.

On the fourth day following surgical intervention the involuntary defecations ceased and on the twelfth day bladder sensation was restored. Daily x-ray films were taken. On the sixth day there was a slight diminution in the volume of air in the ventricles and on the twelfth day very little air remained. Memory was lost for approximately three weeks but returned on the sixth post-operative day.

M. L. CONNELLY, M.D.

THE SPLEEN

The Treatment of Chauffard-Still's Disease. F. LePenetier. Bull. et mém. Soc. Radiol. Méd. de France, 26, 5-9, January, 1938.

Splenectomy, advanced as a procedure for the removal of a focus of infection in Chauffard-Still's disease, has, in a few cases, shown remarkable but transient beneficial effect. The author suggests that, previous to such radical intervention, the effect of roentgen therapy over the spleen should be tried, in view of the known results of small doses of roentgen rays in other inflammatory conditions.

S. R. BEATTY, M.D.

Roentgen Treatment of Certain Hemorrhagic Disorders. L. H. Garland. Calif. and West. Med., 49, 123-126, August, 1938.

This article, together with the discussion, form an important contribution to the roentgen literature as to the value of roentgen irradiation of the spleen in certain hemorrhagic disorders. There is an excellent review of the literature, together with case reports showing the effect of splenic radiation in cases of purpura hemorrhagica, with marked improvement in the blood platelet count and pronounced decrease in coagulation time. Anyone dealing with these blood dyscrasias cannot help but gain important information from this article.

JAMES J. CLARK, M.D.

THE STOMACH

The Symptoms, Diagnosis, and Treatment of Cancer of the Stomach. J. S. Horsley. Jour. Ark. Med. Soc., 35, 69-74, September, 1938.

The author discusses, briefly, the symptomatology, diagnostic methods, and treatment of gastric cancer. Concerning diagnosis he states that the most helpful aid is roentgenology but that the examination must be done by one who is skilled in the method. The most important point is early diagnosis. Surgical excision is the only satisfactory treatment for cancer of the stomach, according to the author. The article contains nothing new but is a good résumé of current opinion

face is increased due to secondary beta rays by 128 per cent for 0.5 mm. Pt and by 90 per cent for 1.0 mm. Pt. The author also points out that this has to be considered when using the photographic method of Holthausen for the calibration of radium preparations. The films used for the dosage measurements must never be exposed to the secondary beta rays of the filter because this might lead to errors of 100 per cent.

ERNST A. POHLE, M.D., Ph.D.

ROENTGEN-RAY THERAPY

The Scope of Radiotherapy. H. H. Navid. *South African Med. Jour.*, 12, 321-323, May 14, 1938.

The author evaluates the therapeutic possibilities and results of radium and x-ray therapy in carcinoma of the cervix, the breast, and the prostate; in lymphadenoma, leukemia, and in metastatic tumor invasion. Only radiologists with adequate equipment and experience should attempt to do radiotherapy.

ERNST A. SCHMIDT, M.D.

The Technic of Roentgen Therapy of Curved Surfaces. A. Proppe. *Strahlentherapie*, 62, 109, 1938.

This is a mathematical study of the problem of irradiating curved and irregular surfaces. Several graphs shown in the article permit the calculation of the proper F. S. D., at the same time avoiding the overlapping of neighboring fields.

ERNST A. POHLE, M.D., Ph.D.

Radiation Therapy in Gynecology. Subodh Mitra. *Jour. Indian Med. Assn.*, 7, 404-407, April, 1938.

The author discusses the application of radiotherapy in the more common gynecologic conditions and stresses the desirability of radiologic training for the gynecologist and of gynecologic experience for the radiologist.

ERNST A. SCHMIDT, M.D.

SILICOSIS

Roentgenographic Studies of the Excretion of Dusts from the Lungs. A. E. Barclay, K. J. Franklin, and R. G. Macbeth. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 673-686, May, 1938.

Insufflation of various dusts of the opaque variety into the lungs of cats failed to reach the alveoli and the dust was excreted from within a few hours to three days. When the same dusts were suspended in liquids the alveoli were reached and massive collapse resulted and progressed even after most of the initiating agent was excreted. The ciliated epithelium appears to be able to arrest dry but not liquid dust.

S. M. ATKINS, M.D.

A Study of Silicosis. Philip B. Matz. *Am. Jour. Med. Sci.*, 196, 548-559, October, 1938.

Persons engaged in dusty occupations, in which

there is a silicotic hazard, in the manufacturing and mechanical industries alone, number 1,200,000. The seriousness of silicosis, which now constitutes the greatest single industrial hazard, is due to the fact that tuberculosis is a very frequent complication.

In a group of 167 silicotic veterans, the majority acquired the disease before the age of 40. The extrinsic factors, such as the type of silica dust, its concentration, length of exposure, and certain intrinsic factors, such as the rate of nodule formation and the presence of pre-existing tuberculous or non-tuberculous infection, which alter the prognosis markedly, influence the duration of the disease.

The cases were divided, according to Sampson's classification, into first, second, and third degree silicosis. The classification depended on the following: the size of the nodules; conglomerate silicosis; silicosis with tuberculosis, in which the two diseases exist as more or less separate entities; silico-tuberculosis, in which one disease cannot be separated from the other, and asbestosis. Over half of these cases showed evidence of tuberculous infection, most of which were classified as being moderately or far advanced.

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BENJAMIN COPLEMAN, M.D.

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L. G. JACOBS, M.D.

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Osteoma of the maxillary sinus is a very rare tumor, the total number of cases reported to date being 29. The author discusses in considerable detail the theories as to origin, anatomy and histology, signs, symptoms,

Three-year Cure of a Case of Melanosarcoma. Drevon and Mourgues. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 73-77, January, 1938.

A case of melanosarcoma of the palm of the hand treated by extensive electrocoagulation shows no evidence of recurrence or of metastasis after three years. A pronounced melanuria has disappeared. The histology and differential diagnosis of pigmented neoplasms are briefly discussed.

S. R. BEATTY, M.D.

The Surgical Standpoint Regarding Radiation Therapy of Malignant Tumors. F. Sauerbruch, in collaboration with K. Middeldorpf. *Strahlentherapie*, 63, 256, 1938.

The famous chest surgeon of the University of Berlin outlines his conception of the proper relationship between surgical and radiological procedures. He concludes that only by close co-operation and the absence of any competitive spirit between surgeon and radiologist will we succeed in improving our results in the treatment of malignant neoplasms.

ERNST A. POHLE, M.D., Ph.D.

Mixed Tumors of the Hard Palate. Frederick T. Hill. *Ann. Otol., Rhinol., and Laryngol.*, 47, 317-325, June, 1938.

The author discusses the differential diagnosis of mixed tumors situated in the hard palate and reports four cases. These tumors are not especially common. They may occur at almost any age but are commonest in the fourth decade. They usually have been present for years without symptoms, except such as may be due to location and size. They are usually single, circumscribed, sessile, and with a smooth non-ulcerating surface. Among the lesions with which they may be confused are inflammatory abscess, gumma, osteoma, sarcoma, or epithelioma. Biopsy may be needed to establish the correct diagnosis. These tumors are generally regarded as potentially malignant and tend to recur after removal. Complete surgical removal, to be followed by post-operative radiation, if the histological examination shows malignant tendencies, is the generally accepted treatment. The histological picture is similar to mixed tumor of the parotid but carcinomatous changes are far less common.

L. W. PAUL, M.D.

The Meningiomas: From a Roentgenological Viewpoint. Charles Wadsworth Schwartz. *Jour. Roentgenol. and Rad. Ther.*, 39, 698-712, May, 1938.

Meningiomas constitute about 15 per cent of all intracranial tumors. On the whole, they grow very slowly. Grossly, there are the roughly globular, well encapsulated, and the flat, poorly encapsulated types. Neither metastasizes, although the flat type

may invade the overlying bone which is then stimulated to produce hyperostoses. They are most likely to occur where the arachnoid granulations are most common.

In the group of 129 cases discussed, 79 per cent showed definite x-ray evidence of intracranial pathology and in all but 26 a diagnosis of meningioma was possible. The location and extent was, however, frequently uncertain, but, with encephalography, positive findings resulted.

Roentgen findings, though not always present, consisted of atrophy of the sella turcica (50 per cent) and localized hypervascularity (25 per cent). Localized hyperostosis was present in 33 per cent, recognizable calcium deposit in 2 per cent, and localized bone atrophy from direct pressure in 0.5 per cent.

Radiation therapy is disappointing since only a small percentage of cases show mitotic figures, but in these, from 2,500 to 3,000 r with the protracted method should be tried.

S. M. ATKINS, M.D.

Adamantinoma of the Tibia. Benjamin Wolfort and David Sloane. *Jour. Bone and Joint Surg.*, 20, 1011-1018, October, 1938.

After a review of the literature, the authors report two additional cases of adamantinoma of the tibia, as shown by biopsy. The roentgenographic picture is not diagnostic, nor does the growth seem to be affected by irradiation.

JOHN B. MCANENY, M.D.

Progress of a Case of Lymphocytoma. Brillouet and A. Viel. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 233, 234, April, 1938.

The authors trace the progress of a case of lymphocytoma treated with roentgen rays at various times for lesions of the tonsil, rectum, mediastinal nodes, and pelvic region. This case was maintained in good health for almost six and one-half years.

S. R. BEATTY, M.D.

Renal Tumors. James C. McClelland and Jesse R. F. Mills. *Urol. and Cutan. Rev.*, 42, 631-634, September, 1938.

Sixty-nine cases of renal tumor are reported, 44 of which were examined pathologically. The etiology, pathology, sex incidence, symptoms, examination, diagnosis, x-rays, treatment, and results are reviewed.

In treatment, the authors stated that 13 cases received deep x-ray treatment but admitted that in most of these cases the growth was so advanced that x-ray therapy was used as a last resort. With few exceptions the results were discouraging. Late diagnosis was given as the outstanding reason for the poor results. The authors are using 400,000 volts as a pre-operative treatment for their present cases.

JOHN G. MENVILLE, M.D.

THE UTERUS

The Treatment of Carcinoma of the Cervix in the Women's Clinic of the University of Königsberg from 1910 to 1937. F. v. Mikulicz-Radecki. *Strahlentherapie*, 63, 414, 1938.

During the period covered by this report, 1,479 women with carcinoma of the cervix were admitted to the author's clinic and he presents a complete statistical analysis of this material. Of 1,071 patients treated during the last 22 years, 169 (or 15.7 per cent) were free from disease after a five-year period. This percentage is not as good as that given in other statistics and is explained by the fact that before 1919 radium and roentgen technic were still in their infancy. Since 1932, operable cases of Groups I and II have been operated upon and the author prefers the vaginal radical extirpation. From 1932 to 1937, a total of 458 cases of carcinoma of the cervix were seen. Thirty-four per cent were operated upon with a mortality of 4.4 per cent. The remaining patients were subjected to irradiation with a mortality of 3 per cent. Combined x-ray and radium therapy was used. Only 50 cases treated during 1932 were available for a five-year follow-up. Seven of these belonged to Group I, 18 to Group II, 24 to Group III, and one to Group IV. The respective numbers cured were seven, six, two, and none; six in Group I were operated upon and one was irradiated; six in Group II operated upon, and the two in Group III were irradiated. These results again clearly indicate the importance of early diagnosis and treatment.

ERNST A. POHLE, M.D., Ph.D.

Factors Relating to Treatment of the Cervix Uteri. G. H. Johnson. *Jour. Ark. Med. Soc.*, 35, 74-77, September, 1938.

This article details the method used in treating cancer of the cervix at the Folsom Clinic of the University of Arkansas School of Medicine. It follows closely the technic used at the Josephine Lendrim Tumor Clinic of the Paterson General Hospital, in Paterson, N. J. The intra-uterine radium capsule is made up of a number of platinum cells each containing 3.33 mg. of radium. A Curie colpostat is used for vaginal irradiation. Most patients receive radium before x-ray treatment is given. Those with advanced lesions usually are given a course of roentgen irradiation first. This is given through multiple pelvic portals by the protracted method. The radium for intra-uterine application is filtered through 1 mm. of platinum, 40 mg. of radium being used with an additional 40 mg. in the vaginal colpostat. A total

dose of about 6,000 mg.-hours is given which requires 75 hours to deliver.

L. W. PAUL, M.D.

Thirty Years' Experience in the Treatment of Carcinoma of the Uterus. A. Mayer. *Strahlentherapie*, 63, 407, 1938.

In the Women's Clinic of the University of Tübingen, carcinoma of the cervix is usually treated by a combination of x-rays and radium. In operable cases of carcinoma of the fundus, operation is given preference. Intra-uterine radium application is considered contraindicated if there is necrosis or suspicion of carcinomatous infiltration of the uterine wall which might lead to perforation following radium therapy. Carcinoma of the cervix during pregnancy is also operated upon as well as the adenocarcinoma of the cervical canal. The author likewise recommends operation in carcinoma of the cervix in young women. Patients who have radiation therapy and do not show any response within six or eight weeks are also operated upon. The same is done with cases in which the cervical growth disappears and heals while a bloody discharge remains, indicating newgrowth in the depth. Vaginal stenosis following irradiation with continued discharge, and operable recurrences following irradiation, are also sometimes referred to surgery.

ERNST A. POHLE, M.D., Ph.D.

THE WRIST

Os Centrale of the Wrist. R. O. Tanguy. *Bull. et Mém. de Radiol. Méd. de France*, 26, 192-194, March, 1938.

Illustrations of a case of "os centrale," without calcification of the anomalous bone, are presented.

S. R. BEATTY, M.D.

Traumatic Axial Rotation by Gear Movement of the Carpal Scaphoid and Trapezium with Subluxation and Foreshortening of the First Metacarpal. Adolph A. Schmier and Michael S. Burman. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 945-949, June, 1938.

An unusual type of injury to the carpal scaphoid and trapezium is described and illustrated by photographs, radiographs, and a cadaver study of the mechanics involved.

IRVING I. COWAN, M.D.



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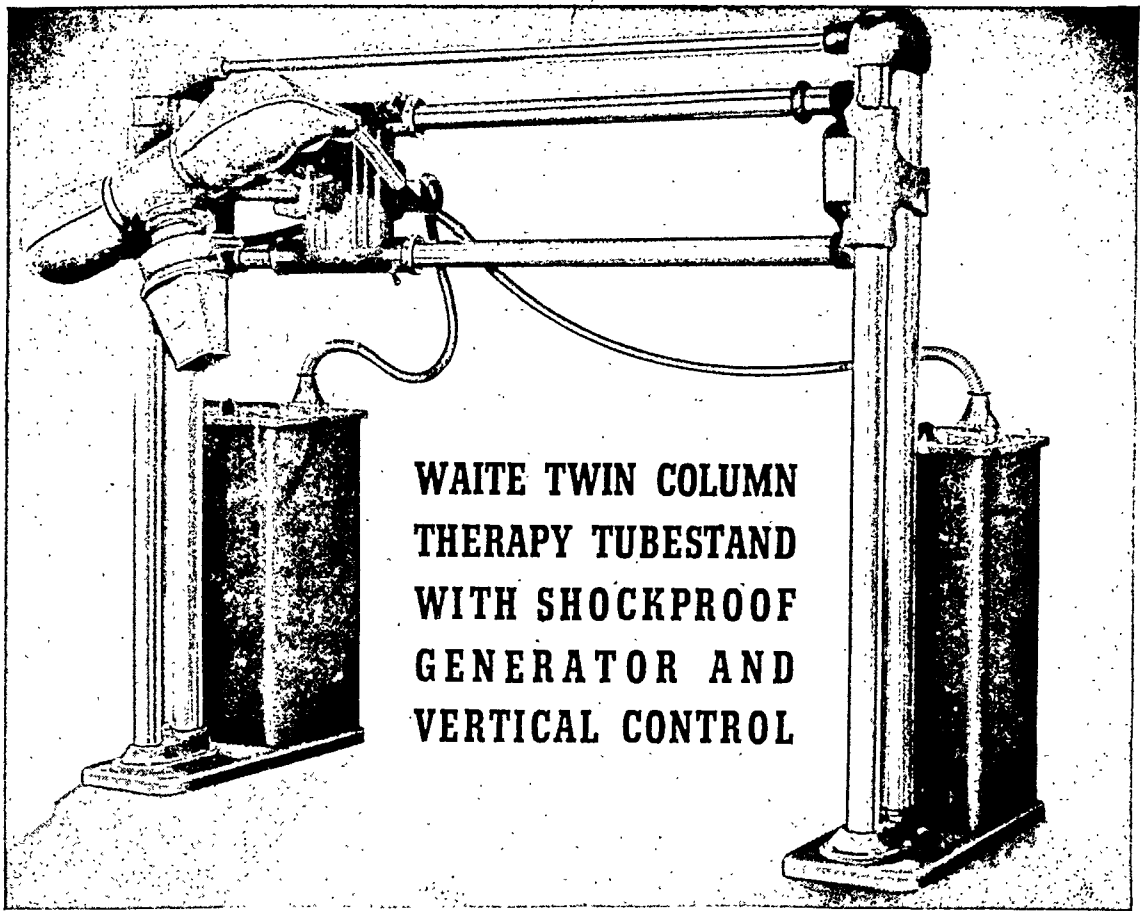
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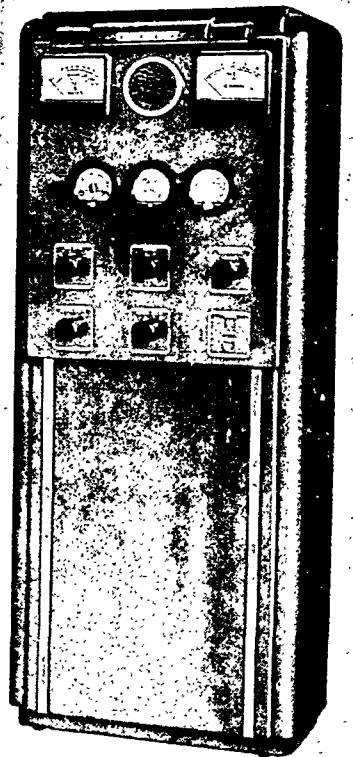
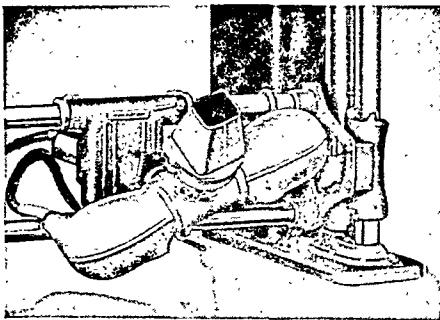
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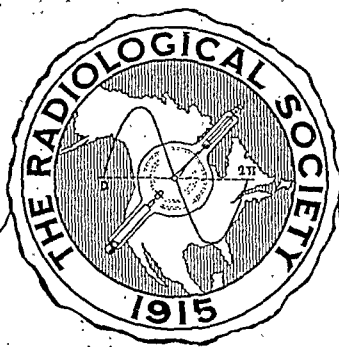
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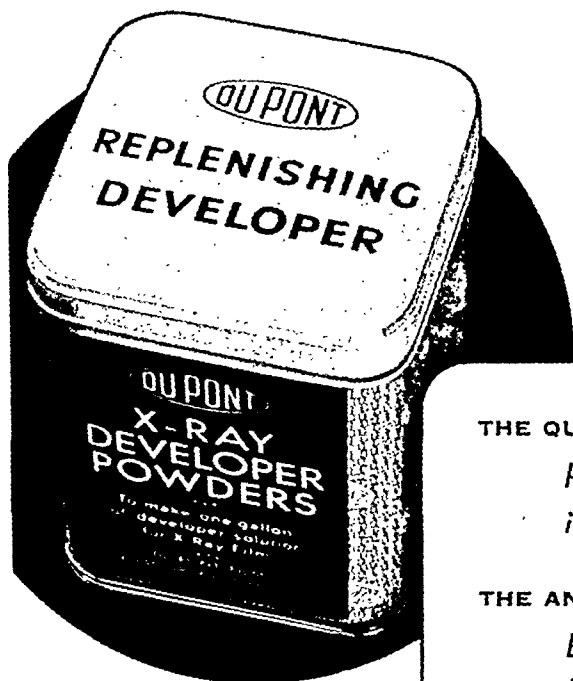
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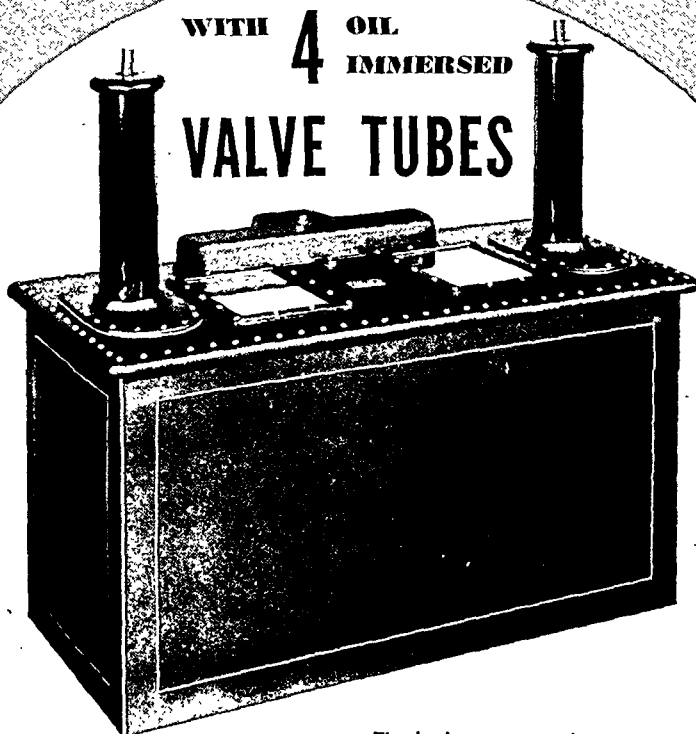
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GENERAL INFORMATION

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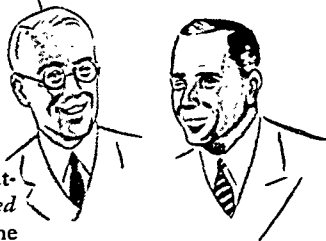
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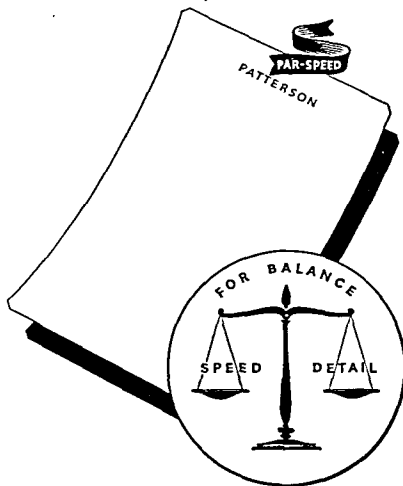
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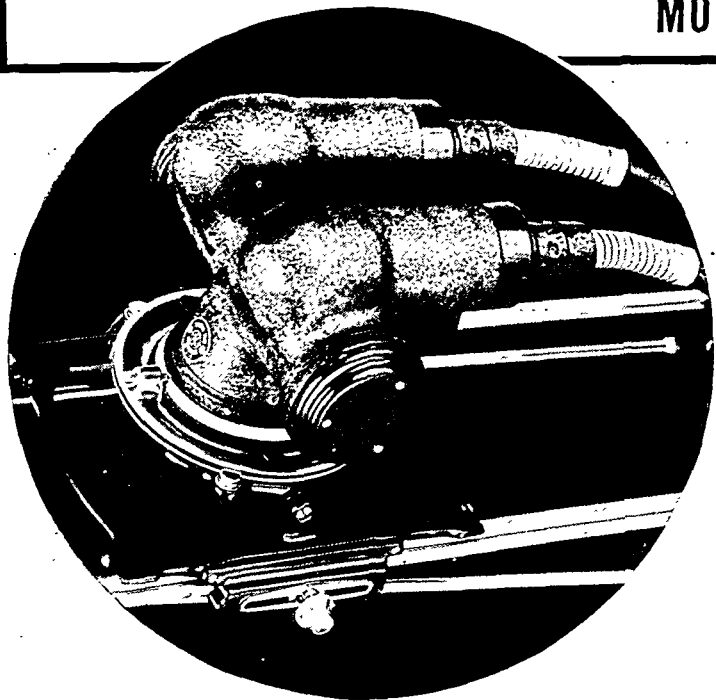
A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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OSTEOGENESIS IMPERFECTA TARDA¹

By J. FLETCHER LUTZ, M.D., and LEWIS C. PUSCH, M.D., *York, Pennsylvania*

From the Departments of Radiology and Pathology, York Hospital

“ OSTEOGENESIS imperfecta is a disorder of bone formation in which increased fragility is the most important manifestation.” This is the definition given by Fleming, Radasch, and Williams (1). The name osteogenesis imperfecta congenita was coined by Vrolik (2) in 1845, and described by Knaggs (3) as, “A disease which is characterized by a congenital defect in the evolution of the osteoblast, and recognized clinically by defective ossification of the cranium and multiplicity of fractures resulting from trivial causes.”

The first case in the literature was reported by Armand (4) in 1716. According to von Recklinghausen (5), 30 cases of osteogenesis imperfecta (osteopsathyrosis congenita or fragilitas ossium congenita) were known in the literature to 1910. This number has been greatly increased since the utilization of the roentgen rays in diagnosis. A thorough clinical and probably the first anatomical description was made by von Lobstein (6) in 1833. The term “Lobstein’s disease” is still encountered, to which he applied the name “idiopathic osteopsathyrosis.”

Great confusion has existed in the past and continues to exist in contemporary

literature with reference to the classification of brittle and soft bones. Such a situation is easily understandable when it is considered that in many instances of abnormality of the bones there is no known etiology, and in some cases there is failure to represent even a recognized syndrome. Knaggs (3) has divided this disease into four types: the fetal form, the infantile variety, the third variety affecting childhood and adolescence, and the fourth variety the disease of middle and old age. Fairbank (7), who has given this disease considerable regard, has also described four different types, as follows:

1. The fetal—similar to Knaggs’ (3) No. 1.
2. The honey-combed bone type—older children, extreme fragility, large unossified areas in the bone, no definite family history.
3. The slender bone type—similar to Knaggs’ (3) No. 3 or fragilitas ossium tarda.
4. The marble bone type or Albers-Schönberg disease. The last is undoubtedly a variety of osteogenesis imperfecta, but is often considered as a separate entity because so many cases have now been described. Fairbank has excluded Knaggs’ doubtful adult form.

Babcock (8) has classified idiopathic fragility in the following manner:

¹ Presented before the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

1. Hereditary type. Hereditary hypoplasia of the mesenchyma.
2. Non-hereditary congenital type.
 - (a) Osteogenesis imperfecta congenita.
 - (b) Osteogenesis imperfecta tarda (osteopsathyrosis).
3. Non-hereditary acquired type. Osteosclerosis fragilis generalisata.
4. Senile type. Osteoporosis.

Key (9) has given to the cases which show hereditary characteristics, such as china blue sclerae, a tendency to fragilitas ossium, hereditary deafness, and hypermotility of the joints, the name "hereditary hypoplasia of the mesenchyme," claiming that the abnormalities seem to be due to defects in the development of some of the tissues which arise from the mesenchyme.

The etiology is unknown, however, several theories have been advanced. Key (9) and Kersley (10) believe that this disorder is due to "congenital instability of the mesenchyme." Weber's (11) studies led to the conclusion that the functional location in this disorder is in the walls of the blood vessels and the composition of the intercellular substances. Kraus (12), Wyatt and McEachern (13) found evidence of changes in the glands of internal secretion. Some investigators suspect a faulty metabolism resulting from various

endocrine disturbances. However, the endocrine glands have been found normal at necropsy by Kraus (12), and recently by Hennessy (14). The calcium and phosphorus content of the affected bones is normal. Others consider a developmental anomaly of the mesoblast. Bauer (15) was one of the first to advocate this theory. He suggested a deficiency of all mesenchymal tissues and showed histological abnormalities in bone, cartilage, and tooth pulp. The disease may be due to a deficiency in phosphatase production. This "phosphate-splitting enzyme" was described by Robison (16) in 1923. It is most plentiful in ossifying portions of normal bone. Robison's (16) theory has received support in the work of Kay (17), who finds that the osteoblasts and hypertrophied cartilage cells secrete this enzyme. Kay feels that the deficiency of bone formation with abnormal softening permits a slow leakage of phosphatase into the blood, perhaps by being "squeezed

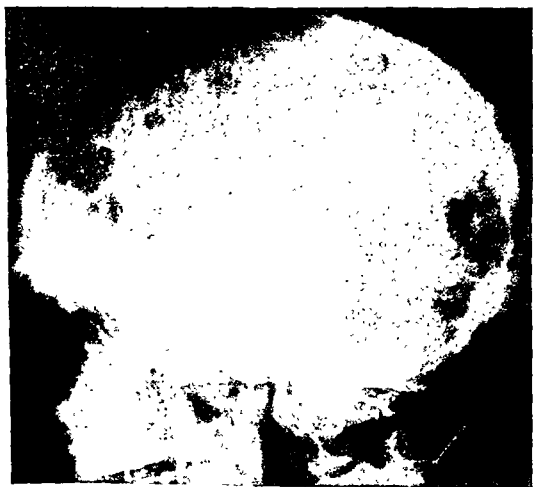


Fig. 1. Skull, lateral view, showing marked thinning of the calvarium; marked degree of osteoporosis and decalcification.



Fig. 2. Skull, anteroposterior view, showing marked thinning of the bones of the calvarium, decalcification, and osteoporosis; marked widening of skull between the parietal bones.

out" of the pliable bone, and that the uniform rate of renal excretion permits a steady rise in the blood concentration of the enzyme. However, Smith and Mitchell (29) find, in reviewing the literature, that the blood phosphatase usually is normal in osteogenesis imperfecta, being moderately increased only in some younger children.

THE CLINICAL ASPECT

According to Knaggs' (3) classification, we have:

1. The fetal form in which the case is still-born or survived only a short time. Numerous fractures of the ribs and long bones, especially of the extremities, are found. Some of these fractures may have united. Ossification of the skull is incomplete. The skull is little more than a membranous bag.
2. The infantile variety, which is a continuation of the fetal disease, and may survive a few months or a year or two, is less severe than the fetal type. They drag along with numerous fractures occurring with the least touch, and the skull does not show the membranous bag type, and the development of the cranial vault is more complete, though still very imperfect.
3. The third variety is the one affecting childhood and adolescence, and has been termed "osteogenesis imperfecta tarda" and "idiopathic fragilitas ossium." In this type of case the infant is apparently born healthy and may have a normal childhood except for fractures occurring in the long bones from the slightest cause. There is often some evidence of defective cranial ossification, but in other cases the changes may be so slight as to be almost absent upon clinical examination. Some of these cases show a tendency, as the patient advances in age, toward less liability for fractures to occur. Heredity frequently plays an important part in some of these cases. There may be two or three of these children affected, and occasionally a whole family, and more rarely several generations will show the taint. The cases which show hereditary tendencies in particular, have a gray-blue coloration of the sclera.

Looser (18) pointed out that these cases of multiple fractures presented the same

pathological peculiarities as the infantile cases, and suggested for them the designation of "osteogenesis imperfecta tarda." It is this third variety in which we are especially interested.

Certain cases of this type show hereditary characteristics, the most outstanding of which is the blue sclera, which Henschel (19) first noted in 1831. In 1848, Cornaz (20) pointed out the relationship between these multiple fractures and the blue sclera. Deafness often appears in this disease after 20 years of age, as was mentioned by Van der Hoeve and de Kleijn (21) and Bronson (22) simultaneously in 1918, and is probably due to otosclerosis. This condition accompanies the blue sclera and the brittle bones in 40 per cent of the cases. Heredity was a factor in 28 per cent of the cases collected by Fairbank (7, 23). The shape of the skull is a characteristic sign. The forehead is broad with the parietals tending to bulge over the ear, giving the face a sort of triangular appearance. There may be a laxity of the ligaments and miscellaneous abnormalities of the teeth, nails, and hair. One or more of these symptoms may be associated with the brittle bones. It was to this class of cases of hereditary fragilitas ossium, associated with the blue sclera, that Key (9) has given the name of "hereditary hypoplasia of the mesenchyme." The tendency to brittle bones becomes less frequent as the patient advances in age.

4. The fourth variety is the disease of middle life or old age. Osteogenesis imperfecta, in an active state, is of rare occurrence in later life. Cases have been reported which have been quiescent and later have had a relapse and showed activity. A case was reported by Ormerod, in 1859, in which the patient lived to be 68 years of age.

ROENTGENOGRAPHIC STUDY

The fetal type shows marked decalcification of all the bones. There are numerous fractures of the long bones and ribs, and the skull shows a few small, thin, isolated

plates of bone. The skull is practically a membranous bag. The infantile variety presents practically the same picture as

as "osteogenesis imperfecta," "osteogenesis imperfecta congenita," "osteogenesis imperfecta tarda," and "osteopsathyrosis

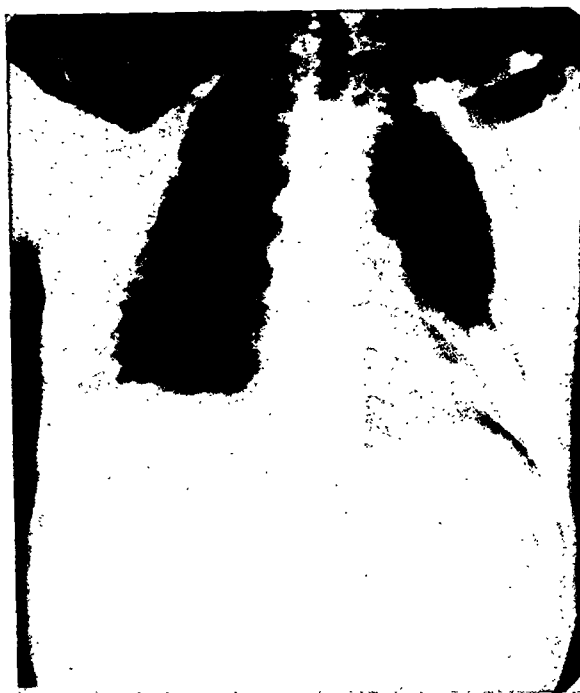


Fig. 3.

Fig. 3. Chest, showing osteoporosis of the ribs: old fractured ribs and clavicle: decalcification of the bones. Upper portion of chest is narrow.



Fig. 4.

Fig. 4. Lower thoracic and lumbar spine and pelvis. Scoliosis of lumbosacral vertebrae: kyphosis of the lumbar spine: marked osteoporosis of pelvis, and decalcification.

the fetal type except that the condition is not so pronounced. The skull does not present the bag-type effect but the bones are extremely thin, especially the two parietals, and the anterior fontanelle is widely open. The third type, *osteogenesis imperfecta tarda*, shows evidence of old, united fractures, marked bowing of the long bones, and decalcification. The long bones show marked thinning of the cortex and a narrowing of the shaft. There is usually some curvature of the spine and marked osteoporosis of all the bones.

REVIEW OF THE HISTOPATHOLOGY

Almost all case reports, and almost all generalizations in text-books regarding the pathologic anatomy and histopathology of that osseous dystrophy known variously

idiopathica," are based on autopsies on infants. The present review is based on generalizations given by MacCallum (27) and Kaufmann (28) and on case reports with discussions by Knaggs (3), Smith and Mitchell (29), Hennessy (14), and Weber (11). Of these, Knaggs alone describes a case in an adult, based on the study of a skeleton.

There is more or less general agreement that the epiphyses exhibit no striking change, but most authors mention that ossification of the calcified cartilage columns is deficient; Knaggs and Hennessy ascribe this to insufficient, and to immature, osteoblasts, respectively. Distortion of the trabecular pattern results.

As regards the diaphysis, the periosteum, when mentioned, is described as being thickened, except that Hennessy

considered it to be thin in his case. All who mention the cortex agree that it is either lacking, thin, or discontinuous. When present, it is composed of incompletely calcified and of uncalcified osteoid trabeculae, often diminished in number, thin, unevenly stained because of uneven calcification, with irregular lamellae. These trabeculae are lined with osteoblasts and in many instances osteoclasts are numerous. Well-defined trabeculae are lacking in some cases. Their rôle is taken by a so-called "fiber-bone" of intercellular matrix, which later becomes calcified, and by fibroblasts. Instead of the usual marrow and adipose tissues, the medulla is either fibrous or lymphoid, supporting poorly calcified trabeculae. Often cortex and medulla are structurally indistinguishable, a sparse, thin matrix of abnormal trabeculae supported by stroma, extending from periosteum to periosteum throughout the cross-section of the shaft.

In the case occurring in an adult, Knaggs describes slender, elongated trabeculae with a fibrous laminated structure in some parts, while other portions resembled normal laminated bone. Larger trabeculae presented an irregular excavation of the surface, the excavations being bordered by deeply eosin-stained thicker substance.

Various abnormal types of callus formation are described at fracture sites. Kaufmann refers to a metaplastic bone formation; Smith and Mitchell to fibrillar healing with an increase in the number of trabeculae, and Weber to a callus of cartilage and fiber bone.

TREATMENT

Glassner and Hass (24) studied the effect of thymus upon the healing of bone, and upon investigation it was found that in cases in which the thymus had been removed, fractures were slow in uniting, while William J. Ryan (25) reported two cases in which the administration of thymus gland by mouth had a beneficial effect upon this disease. Fleming, Radasch, and Williams (1) reported improvement after the administration of

dilute hydrochloric acid, high protein diet, and cod-liver oil. Secord and Wilder (26) noted improvement in this disease after the daily injection of the thymus extract.

CASE REPORT

A white male, 26 years of age, was admitted to York Hospital on the service of Dr. C. C. Spangler on Sept. 10, 1937, following an automobile accident. Transverse fractures of both tibiae and fibulae, of the right femur, and of the second, third, fourth, and fifth ribs of both sides of the chest were demonstrated roentgenologically. Both legs were deformed from injuries in the past; the right femur was bowed anteriorly, and the right tibia and fibula were bent backward to form a semi-circle.

It was learned that a series of frequent and readily produced fractures had occurred, beginning at the age of three years. The right leg had been broken thirteen times, requiring five open operations. The left leg had been broken four times. Many of these fractures followed negligible injuries, such as the jolts consequent to riding in a wagon. There had been various periods of hospitalization for these fractures. Dr. George E. Bennett, of Baltimore, tells us there were four admissions to the Children's Hospital School of Baltimore between 1919 and 1924. He was in the Gettysburg Hospital on the service of Dr. J. McCrae Dickson in 1927 and in 1928, and in the Hanover Hospital on the service of Dr. F. W. Wright in 1931. There also had been a previous admission to York Hospital in 1936, when he was on the service of Dr. John F. Bacon.

Birth is said to have been normal, not difficult, spontaneous, and at full term. Infancy was uneventful and without indication of osseous disease until the age of three years. Dates of teething and of sitting up are not known, but he began to walk at about one year of age. It could not be remembered whether sclerae ever were blue. No other members of the family were afflicted with an osseous dys-

trophy. Eleven siblings were living and well; another had typhoid fever. There was no blood relationship between mother and father.

Physical examination on admission revealed little of note beyond the pain and tenderness consequent to the recent in-

jury of the middle third of the tibia, a comminuted fracture of the middle third of the fibula, and a transverse fracture of the middle and upper thirds of the femur. There is marked bowing of the entire leg, extending from the acetabulum to the ankle. The bowing of this leg makes a



Fig. 5.

Fig. 6.

Fig. 7.

Fig. 5. Humeri, showing thinning of the cortex; osteoporosis and decalcification.

Fig. 6. Both forearms. Thin cortex; osteoporosis and decalcification.

Fig. 7. Right femur, showing marked curvature; thin cortex; decalcification; osteoporosis. Recent fracture.

juries and the deformities of older lesions previously mentioned. The blood pressure was 118/82, the pulse 108, respiration 24, temperature normal. The hair of the scalp was sparse. Repeated urinalyses were normal. The hemoglobin estimation was 14.5 gm., the red blood cell count 4,610,000, the white cell count 5,900. The blood Kahn test was negative. The blood calcium determination was 8.9 mg. per 100 c.c., the blood phosphorus 2.2 mg. The body height was 160 cm. (5 ft. 3 in.). Roentgenological studies are summarized below.

ROENTGENOLOGICAL STUDIES

X-ray Examination of Right Leg (Sept. 10, 1937).—There is a transverse fracture

complete circle. There is marked decalcification of bones, with some osteoporosis.

X-ray Examination of Left Leg (Sept. 10, 1937).—There is a transverse fracture of the lower third of the tibia and fibula, 3 cm. above the articulation. Marked decalcification, with some osteoporosis, is present.

X-ray Examination of Skeleton Generally (Oct. 6, 1937).—The skull shows marked osteoporosis, with thinning of all the bones of the calvarium. The transverse diameter of the skull shows marked widening between the parietal bones. There is some shortening of the vertical diameter of the skull. The sagittal diameter is increased. The mandible shows an extreme degree of osteoporosis and

numerous teeth have been lost; there is marked absorption of the alveolus of all the remaining teeth.

The thoracic cage shows marked narrowing of the upper half of the chest. There is evidence of numerous old fractures of the ribs, also of both clavicles. There is pronounced osteoporosis of all the bones. There is some scoliosis of the lower thoracic vertebræ.

There is marked scoliosis of the lumbar vertebræ, with marked lordosis of the lower lumbar vertebræ and sacrum. The osteoporosis is not so pronounced in the bones of the spine. All the bones of the pelvis show some osteoporosis.

The right leg has been described. The left leg shows marked bowing outward. There is evidence of an old fracture of the middle third and a Lane's plate is *in situ*. This fracture shows good union. Both humeri show some bowing outward, with some osteoporosis. The same condition exists in the ulna and radius.

X-ray Examination of the Tibia and Fibula, Left Side.—This shows some bowing of the tibia, with pronounced bowing of the fibula. The fracture of the lower third of the tibia and fibula has been mentioned previously. The hands and feet show some osteoporosis of the carpus and metacarpus. The phalanges show little change.

In addition to the marked bowing and osteoporosis, there is pronounced decalcification of all the bones and a pronounced degree of thinning of the cortex of the bones of the extremities. There is little evidence of all the numerous old fractures which have occurred. The recent fractures of the left leg which were x-rayed on Dec. 9, 1937, show the absence of callus formation.

Amputation of the right leg at the upper third of the femur was performed by Dr. C. C. Spangler on Sept. 21, 1937. A plaster cast was applied to the left leg at this time. The post-operative course was uneventful except for a prolonged period of hospitalization during which time the fractured left leg healed very slowly.

The patient was discharged from the hospital on Feb. 11, 1938, with a brace on the left leg. A description of the amputated right leg follows.

THE SPECIMEN

Gross Description.—A right leg amputated 28 cm. above the lower extremity of the femur. The leg is bent into the shape of a hook. Soft tissues everywhere are edematous and atrophic. The femur is bowed outward, with the crest of the convexity 22 cm. above the lower extremity of the bone, to form an angle of 30 degrees. The surface of the bone is smooth and there is no evidence here of a healed fracture. There is a recent, transverse, comminuted, ununited fracture of tibia and fibula near mid-length, with hemorrhage into the soft tissues at the site; the synovial cavity of the knee joint also is filled with blood. No callus or other evidence of healing and repair is observed. Tibia and fibula are bowed outward, with the crest of the curve well below the fracture site, 10 cm. above the lower extremity of the tibia, to form an angle of 45 degrees. Tibia and fibula here are "fused." Femur and tibia have narrow shafts; at one point below the fracture the tibia has a diameter of 8.5 mm.

All bones are abnormally soft. They can be cut with a knife, but with resistance, while very little resistance is encountered on sawing across them at most points. Femur and tibia have solid, gray, granular shafts, with no cortex-medulla demarcation, throughout a series of cross-sections made, medullary cavities being obliterated by apparent osteoid tissue. But a longitudinal section of the lower 20 cm. of the tibia reveals that such a structure is not constant throughout the length of the tibia. Along the convexity of the curve a cortex is lacking, while along the concavity it is hard and compact, although, throughout most of the length, entirely inconspicuous, being 0.5 mm. or less thick; at the site of angulation it attains a thickness of 2 mm. At this site the sur-

face is rough; elsewhere it is smooth. Osteoid tissue fills, or replaces, the medullary cavity down to a point 1 cm. above the articular surface of the lower extremity. Here a sharply demarcated zone of loose, fatty, and cancellous structure intervenes between the osteoid tissue and

teoid tissue. At the point of fusion of tibia and fibula the osteoid tissue filling the shaft of the tibia is continuous with osteoid tissue obliterating the shaft of the fibula at this site, while above and below this point cortex and medulla of fibula are of grossly normal structure. The talus and



Fig. 8.

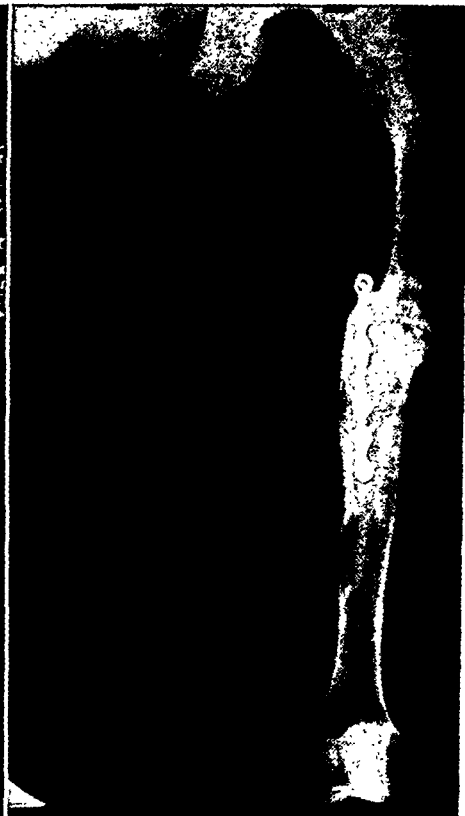


Fig. 9.

Fig. 8. Lower third of right femur, tibia, and fibula. Marked degree of osteoporosis; thin cortex; decalcification; marked curvature of the tibia and fibula. Recent fractures of the tibia and fibula.

Fig. 9. Left femur, showing thin cortex; osteoporosis; decalcification; old united fracture; Lane plate *in situ*.

the articular cartilage; the cartilage is thin and unassociated with a layer of compact bone. The sharp but irregular demarcation between the compact gray osteoid tissue and the loose, fatty, cancellous tissue is striking. The cancellous tissue along the border of osteoid tissue contains a little red marrow. One or two areas, about 1 cm. in diameter, within the osteoid tissue, are more white in color than the remainder. Near the area of curvature a few sclerosed areas occur within the os-

metatarsal bones resemble the lower centimeter of the tibia in having a loose, fatty, and cancellous interior and a thin cartilaginous surface.

Microscopic Description.—Sections of the talus, a metatarsal bone, and of the lower epiphyseal extremity of the tibia present osteoporotic (probably from disuse) but otherwise generally normal structures, with thin trabeculae and cortices, normal periosteum and fatty marrow. There are, however, occasional small areas

in which fibrillar and fibroblastic tissue, instead of adipose tissue, intervenes between trabeculae. In one such area well within the epiphysis of the lower extremity of the tibia, the associated trabeculae are abnormal, irregular in shape, and markedly unevenly stained, quite apparently

mal trabeculae on the diaphyseal side, contrasting with a fatty marrow and sparsely distributed, thin but otherwise normal trabeculae on the epiphyseal side.

The shaft or diaphysis of the tibia consists of a column of fibrillar connective tissue supporting a network of abnormal



Fig. 10.

Fig. 10. Left tibia and fibula, showing thin cortex; osteoporosis; decalcification and some curvature of both bones.



Fig. 11.

Fig. 11. Longitudinal hemisection of lower 20 cm. of the right tibia, with lower portion of fibula attached, showing the marked curvature, "osteoid" tissue filling the medulla of the diaphysis, relatively normal epiphysis, absence of cortex along convexity of curvature, sclerosed along concavity of curvature.

but little calcified. The structure of this small patch is characteristic of the structure of the shafts of tibia and femur. This epiphysis is sharply demarcated from the diaphysis, a fibrocellular marrow supporting numerous, rather bulky, abnor-

trabeculae, bordered in part only by periosteum, in part by a thin, weak, imperfectly formed cortex, and in part—along the concavity of the curve—by a sclerosed cortex of essentially normal structure. The connective tissue supporting the os-

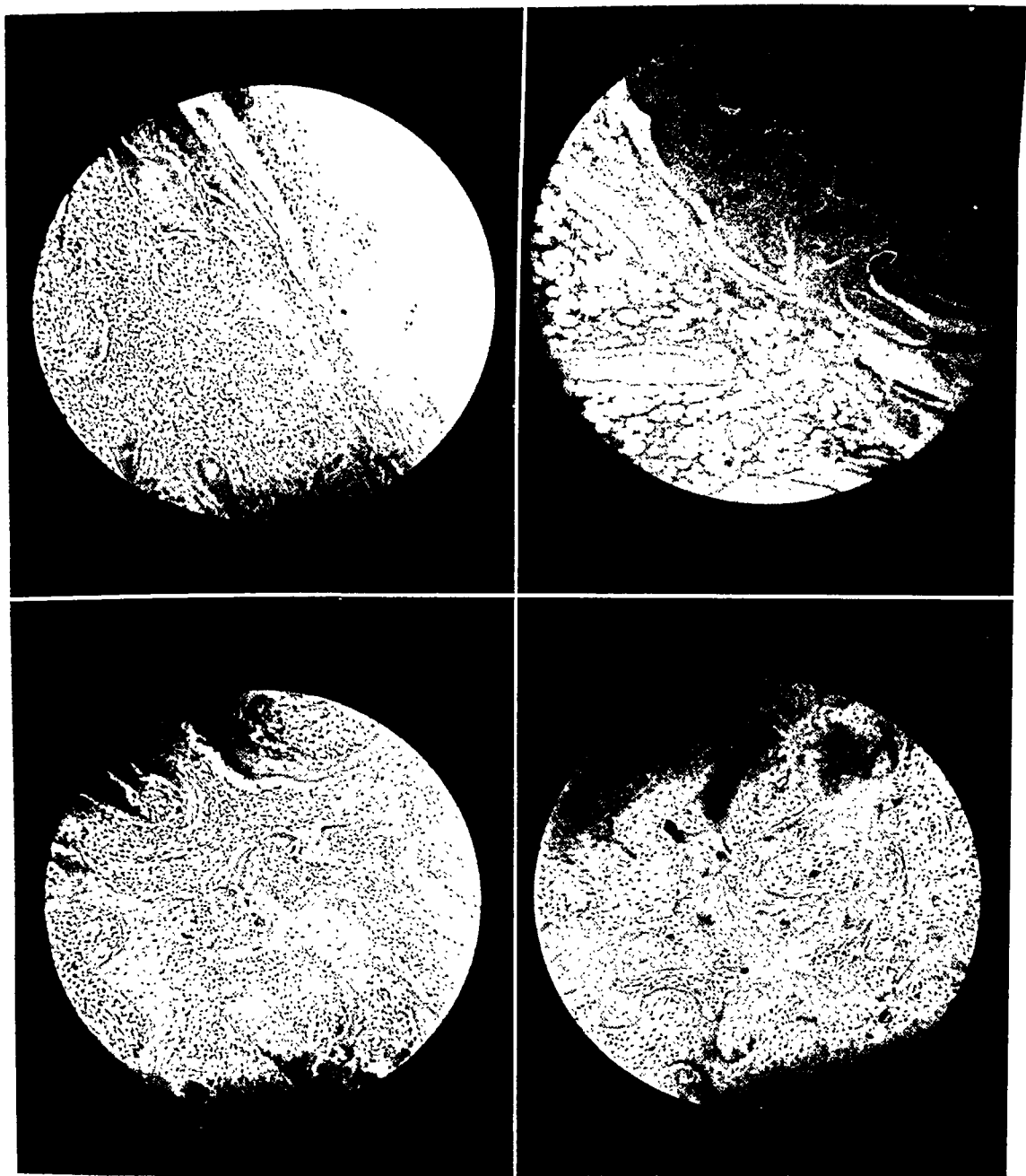


Fig. 12 (*upper left*). Absence of cortex: fibrocellular replacement of fatty marrow. Surface of shaft of tibia.

Fig. 13 (*upper right*). Sharp demarcation between normal epiphysis and abnormal diaphysis. Lower end of tibia.

Fig. 14 (*lower left*). Medulla of diaphysis of femur. Poorly formed, calcium-deficient trabeculae, without lamellae and without any appreciable organization, of bizarre shape, are supported by a compact fibrocellular stroma. But little of their surfaces is composed of an osteoblastic edging. Osteoclastic activity here is prominent.

Fig. 15 (*lower right*). Medulla of diaphysis of tibia. The same general structure as that of the medulla of the femur. Here, however, very few osteoblasts and osteoclasts are seen, and the trabeculae are still more imperfect and more bizarre. Irregularly disposed zones of variable density replace the normal lamellar structure.

teoid trabeculae is loose and edematous, composed of cells with very narrow thread-like processes and ovoid or irregularly spherical, finely vesicular, yet in many instances relatively compact, rather small, nuclei. Many have the stellate shape characteristic of pre-osseous connective tissue. As the bizarre trabeculae are approached the tissue is more cellular, and a gradual transition to apparent osteoblasts, incompletely bordering the trabeculae, can be traced. Osteoclasts occur in scattered areas. Dilated lymphatic vessels are conspicuous. Some areas are rather densely cellular.

The trabeculae present markedly variable structures. A few are relatively normal in size and shape, stain homogeneously with eosin (except for included bone cells), and have sharply defined peripheries edged with fibroblasts and osteoblasts, yet are devoid of lamellae. However, almost all trabeculae are composed of two or more irregularly shaped, indented zones of deeply stained, partly calcified substance, contrasting sharply with very pale uncalcified zones or areas which in many instances have poorly defined peripheries difficult to distinguish from adjacent fibrillar connective tissue. There is no uniformity of distribution of these zones, either occupying a peripheral or a central location within the trabecula in different instances. Some trabeculae are very thin and uncalcified. Some have very irregular, bizarre shapes. All trabeculae contain bone cells. Lamellae and Haversian canals are seen only in the thicker, more normal, sclerosed portions of the cortex. Thinner portions of the cortex, when present, have a structure analogous, in lesser degree, to the trabeculae of the interior of the shaft, just described.

The structure of the shaft of the femur is essentially the same as that of the tibia. Here, however, some trabeculae have irregular, indented peripheries presenting the excavated appearance described by Knaggs. With such excavations prominent osteoclasts are associated.

The point of fusion of tibia and fibula

(probably the "callus" of an old fracture) presents the same structure as that of the tibia.

SUMMARY

The clinical, roentgenological, and structural features of a case which, we feel, should be classified as osteogenesis imperfecta tarda, occurring in a white male 26 years of age, are described. The literature is reviewed.

REFERENCES

- (1) FLEMING, B. L., RADASCH, H. E., and WILLIAMS, T.: *Jour. Bone and Joint Surg.*, 19, 725-733, July, 1937.
- (2) VROLIK: *Tabul. ad illustrandam embryogenesis hominis et mammalium*, Tab. 91, Amstelodami, 1845.
- (3) KNAGGS, R. LAWFOED: Lecture delivered at the Royal College of Surgeons of England on Feb. 13, 1924.
- (4) ARMAND, J., quoted by DRY, T. J.: *Proc. Staff Meet., Mayo Clin.*, 8, 329-331, May 31, 1933.
- (5) VON RECKLINGHAUSEN, F.: *Untersuchungen über Rachitis und Osteomalacie*, p. 472. Gustav Fischer, Jena, 1910.
- (6) VON LOBSTEIN, J. F.: *Traite d'annat. path.*, Paris 2, 204, 1833.
- (7) FAIRBANK, H. A. T.: *British Jour. Surg.*, p. 120, July, 1927.
- (8) BABCOCK, W. W.: *A Textbook of Surgery*. W. B. Saunders Company, Philadelphia, 1935.
- (9) KEY, J. ALBERT: *Brittle Bones and Blue Sclera: Hereditary Hypoplasia of Mesenchyme*. *Arch. Surg.*, 13, 523, 1926.
- (10) KERSLEY, G. D.: *Fragilitas Ossium and Allied Conditions*. *St. Bartholomew's Hosp. Rep.*, 68, 159-200, 1935.
- (11) WEBER, M.: *Osteogenesis Imperfecta Congenita: Study of its Histopathogenesis*. *Arch. Path.*, 9, 984-1006, May, 1930.
- (12) KRAUS, E. J.: *Osteogenesis Imperfecta und Endokrines System*. *Virchows Arch. f. path. Anat.*, 274, 37-49, 1929.
- (13) WYATT, T. C., and McEACHERN, T. H.: *Congenital Bone Dysplasia (Osteogenesis Imperfecta) Associated with Lesions of the Parathyroid Glands*. *Am. Jour. Dis. Child.*, 43, 403-415, February, 1932.
- (14) HENNESSY, J. P.: *Am. Jour. Obst. and Gynec.*, 25, 590-593, April, 1933.
- (15) BAUER, K. H.: *Deutsch Ztschr. f. Chir.*, 154, 166, 1920.
- (16) ROBISON, R.: *Biochem. Jour.*, 17, 286, 1923.
- (17) KAY, H. D.: *British Jour. Exp. Path.*, 7, 177, 1926.
- (18) LOOSER: *Grenzgeb. der Med.*, 16, 165, 1906.
- (19) HENSCHEL, quoted by Bell: *Ztschr. Ophthalm.*, 1, 52, 1831.
- (20) CORNAZ, C. A. E.: *Des abnormities congenitales des yeux et de leurs annexes*. *Lansanne*, p. 67, 1848.
- (21) VAN DER HOEVE, J., and DE KLEIJN, A.: *Blaue Sclera*, *Nederl. Tijdschr. v. Geneesk.*, 1, 1003, March 31, 1917; *Blaue Sclera, Knochenbrüchigkeit und Schwerhörigkeit*. *Arch. f. Ophth.*, 95, 81, 1918.
- (22) BRONSON, E.: *Fragilitas Ossium*. *Edinburgh Med. Jour.*, 18, 240, April, 1917.
- (23) PUPPEL, ITALO D., BARRON, LOUIS E., and CURTIS, GEORGE M.: *Am. Jour. Med. Sci.*, 190, 756-764, December, 1935.

(24) GLASSNER, K., and HASS, J.: Experimentelle Beeinflussung der Callusbildung bei Knochenfrakturen. *Klin. Wchnschr.*, 7, 1633, 1928.

(25) RYAN, WILLIAM J.: *Jour. Bone and Joint Surg.*, 14, 939-942, October, 1932.

(26) SECORD, E. W., WILDER, R. M., and HENDERSON, M. S.: "Osteogenesis Imperfecta Tarda (Osteop-sathyrosis), Treated with Thymus Extract." *Proc. Staff Meet., Mayo Clin.*, 11, 1-5, Jan. 2, 1936.

(27) MACCALLUM, W. G.: *A Textbook of Pathology*, Sixth edition, p. 1009. W. B. Saunders Company, Philadelphia, 1936.

(28) KAUFMANN, EDWARD: *Pathology for Students and Practitioners*. (Translated by S. P. Reiman.) 2, 1063-1065; 1175-1179. P. Blakiston's Son and Company, Philadelphia, 1929.

(29) SMITH, O. N., and MITCHELL, J. M.: *Am. Jour. Med. Sci.*, 190, 765-770, December, 1935.

DISCUSSION

LESTER A. SMITH, M.D. (Indianapolis, Ind.): The essayists have presented a very interesting case and a good review of the literature on this subject of osteogenesis imperfecta. The tarda type is not common, and, as the essayist has said, histological studies on this form have been greatly lacking.

Out of a considerable number of cases of osteogenesis imperfecta which we have observed at the Indiana University Hospitals, the congenital and infantile types have outnumbered the tarda type some sixteen to one. I have not had the opportunity of studying any case of the tarda type with such well marked deformities as has been shown.

There are two particularly interesting features of the case that has just been presented. In the first place, it has been noted by various writers that the tarda type seems, in many of the instances at least, to lose the tendency to brittleness of bones after passing puberty, although in some instances the tendency to fractures does not occur until the third or fourth decade of life.

In the second place, the case is somewhat exceptional also in that the bony structures were found to be so greatly deficient. In these older patients of the tarda type, it has been noted in many cases that the bones tend to be normal in their clinical and radiographic appearance, and yet they will be brittle.

As to the etiology, as the essayist has said, there is a very great deal of confusion

of opinion. There is overlapping of two types—the hereditary and the non-hereditary. We might emphasize that whereas there is no great reason for error in classification as to the individual case as judged from the radiographic appearance, there is much conflict of ideas as regards the etiology and proper classification of the various types.

As to etiology, we might first consider the endocrine relationships, for instance. It has been noted by many writers that no morphological changes in ductless glands have been found as a constant or as a frequent feature, and yet several cases are on record in which a great deal of improvement has followed treatment of the cases of osteogenesis imperfecta by the administration of either fresh thymus tissue or thymic extract.

It has also been noted that such patients, if they can be nursed past puberty, lose in great part the tendency to fractures. It has occurred to me that this should offer an interesting field for the study of the effects of treatment by gonadotropic or actual sex hormones to see what might occur. So far as I know, no such studies have been made.

It has been stated with regard to the hereditary type in particular that it is due to a deficiency of the mesenchymal tissues; others have spoken about an accidental deficiency of the mesenchyma in the non-hereditary types, yet we should keep in mind that various cases have been reported in which there is a deficiency in the dental enamel as well as in other parts of the teeth and, as we know, the former arises from the ectodermal layer.

I feel that, in view of the rarity of reports of histological findings in the tarda type, the essayists have made a real contribution in this study they have presented.

ARTHUR R. BLOOM, M.D. (Detroit, Michigan): I was interested deeply in the paper, but a thought occurred to me as I was listening to it.

The etiology put forth by both the essayist and discussant seems to be due to a

lack of thymus gland or, the corollary, that treating these patients with thymus would help them. I was just wondering about this, particularly since several years ago we were all indiscriminately treating thymus glands with x-ray and in that way reducing the thymus gland.

How many of these patients who have been treated with x-ray for their thymus glands have developed this condition?

J. FLETCHER LUTZ, M.D. (*closing*): I want to thank Dr. Smith for his interest in this paper and the privilege that Dr. Doub gave me of having him open the discussion. I also want to thank Dr. Bloom for his question—which I am unable to answer. Some of the men who have done quite a lot of these treatments can answer that better than myself.

I would like to say that I have prepared this paper very carefully. I only skimmed over it, and I hope it will be published because it covers a subject which is of so much interest to all of us and is such a rare condition in adult life. The symptoms of our

case started at the age of three, when he had his first fracture, and thirty-three fractures followed up to the age of twenty-six.

To me, it is a typical case of osteogenesis imperfecta tarda, which was confirmed by my associate, Dr. Pusch. I am sorry he is not here to say a few words about the pathology.

The work that has been done has been in instances of the disease in youth, childhood, and not in adult life. In fact, there are very few reported cases. Up to 1910, there were only 30 cases of osteogenesis imperfecta tarda reported.

As to the treatment, one case was treated at the Mayo Clinic, in which they claimed excellent results from thymus extract. This came in as a surgical case; we made no effort to treat him. How this young man got along with one leg drawn up in a circle and the other very much deformed, is a mystery to me.

I want to say that I feel it is a privilege to be here and to present this paper. I think the pathological work that has been done on this is a credit to Dr. Pusch.

THE PRESENT STATUS OF MITOGENETIC RADIATION¹

By ALEXANDER HOLLAENDER, Ph.D., *Madison, Wisconsin*²

From the Department of Botany, University of Wisconsin

THE discovery of mitogenetic radiation was first reported by Professor A. Gurwitsch, in 1923. There followed a slowly increasing number of publications on the problem which came to its highest level in 1932-1934, and is now followed by a decreasing number of publications. Little attention was paid to the problem in the early years of its reported discovery, but later it played a prominent part in many discussions on the causes of cell division, and as a possible tool for diagnostic purposes. It was also used as the explanation of many biologic phenomena, the interpretation of which seemed obscure.

The wide application of the reported phenomenon to problems in biology which are often of the most involved type has detracted from the most important questions, *viz.*, is mitogenetic radiation a well established scientific phenomenon; can the existence of this radiation be proven by any investigator with proper training who uses the appropriate procedures?

There is considerable doubt about these points in the minds of many research workers, in spite of the more than 700 articles and the dozen books on the subject.

I will shortly review a few details of the characteristics of the radiation and the procedure in its detection and manipulation. Mitogenetic rays are reported to be ultra-violet radiation of the wave lengths from 1,900 to 2,600 Å., of an intensity of from ten to several thousand quanta/cm.²/sec., and are said to be emitted by many biologic materials and by chemical reactions. This radiation is supposed to cause

increased cell division in certain biologic materials, to initiate or to speed certain enzymatic reactions, and to cause the emission of so-called secondary radiations in many biologic materials which are themselves not able to emit primary radiation.

Mitogenetic radiation is emitted in discrete wave length bands. The width of these bands has been determined to 3 Å. (Decker, 4)! The wave lengths are more or less typical for the chemical reactions taking place. A biologic process will give a spectrum which is composed of bands emitted by the chemical reactions responsible for the biologic process. This offers an apparently simple method of following the chemical processes in biologic materials *in vivo* without interfering with their normal functions (Hollaender, 6).

Biologic and physical methods have been reported to be successful in the detection of mitogenetic rays. Most of the work is done with biologic material. The detectors in most common use are yeast and bacteria. With both organisms use is made of the fact that when a relatively old culture is transferred to a fresh medium, the cells do not begin to divide at once but go through an apparent rest period of several hours. The length of the rest period depends on the age of the culture, the nutrient, the temperature, and on other environmental factors. Cultures which have been exposed to mitogenetic radiation have been reported to come out of the resting period earlier than the control cultures. Thus the main point in these detecting methods is to determine "growth" in such an exact manner that the slight difference between exposed and control can be recognized readily. The growth in yeast is determined either by the increase in the percentage of buds, by the increase in the total number

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of yeast cells, or by increase in volume of the yeast. The percentage of buds is determined by microscopic counts of fixed and stained smears; the total number of yeast cells by counting in a blood-counting

2-A and 2-B. For the detection of a mitogenetic radiation spectrum a fairly light-strong quartz spectrograph is used. The place of the photographic plate is taken by blocks of agar, the surface of

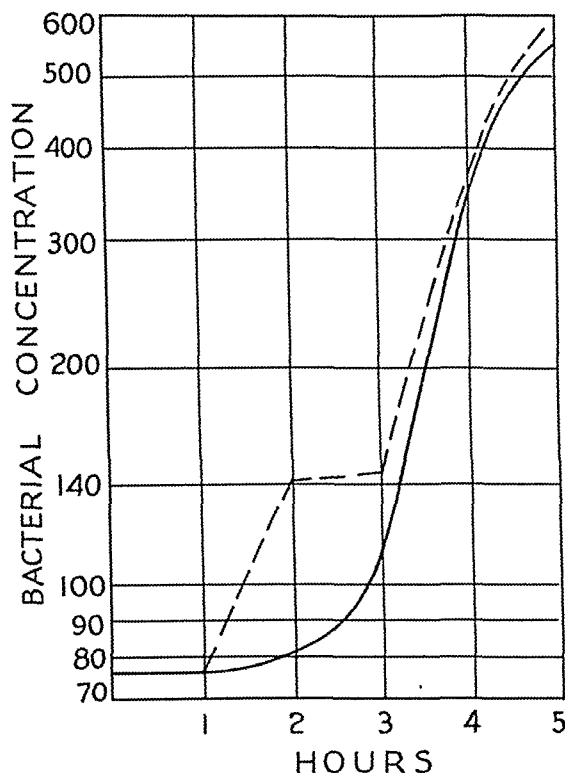


Fig. 1. A typical bacterial growth curve, represented by the solid line. Growth of a bacterial culture after exposure to a mitogenetic ray sender, indicated by broken line. Redrawn from Wolff and Ras.

chamber, and the total volume of yeast by centrifuging the yeast suspension in modified mycetocrit tubes. In the bacterial work the number of bacteria is determined either by direct microscopic counts, by plate counts, or by a modified plate method. In addition to yeast and bacteria, a score of other materials, such as onion roots, bone marrow, eye tissue, enzymes, certain chemical reactions, colloid reactions, etc., have been used. But of all these materials only yeast and bacteria have been retained as standard detecting materials.

A typical experimental set-up for the detection of mitogenetic radiation is extremely simple, as can be seen from Figures

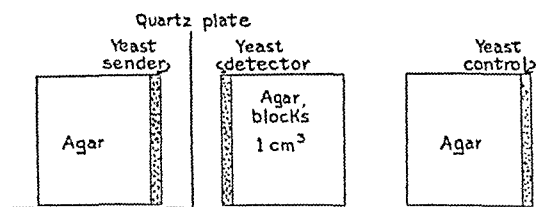


Fig. 2-A.

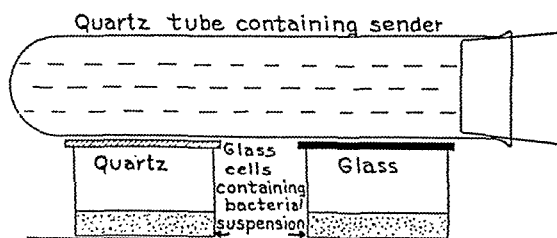


Fig. 2-B.

Fig. 2. Typical experimental arrangements for the detection of mitogenetic radiation. A. Induction experiment using yeast as both sender and detector (muto-induction). B. Arrangement for induction experiment with a chemical or enzymatic reaction as sender, and bacteria as detector.

which is covered with a fine layer of yeast, or by vessels containing the detector in a liquid suspension. Each block or tube covers a definite region of the spectrum (Fig. 3).

The following factors are usually reported to be of greatest importance for the detection: the age of the culture; the medium of exposure; the concentration of the organisms during exposure, and the separating surfaces between sender and detector, the time of exposure, the treatment of the detector after exposure, and use of a proper sender.

The age of the culture should be such that a well-defined "lag" phase is present. In spite of the fact that beerwort, beef broth, and serum are highly absorbing for ultra-violet radiation of the mitogenetic wave lengths (1,900 to 2,600 Å.), these materials are supposed to be good suspension media for the detector. The explanation given is that these substances are good

secondary senders and that they transmit the effect from and to the cells below the surface. The acceptance of "secondary

After exposure the detector is handled so that the effects can be brought out most clearly. Thus, for instance, in the bud-

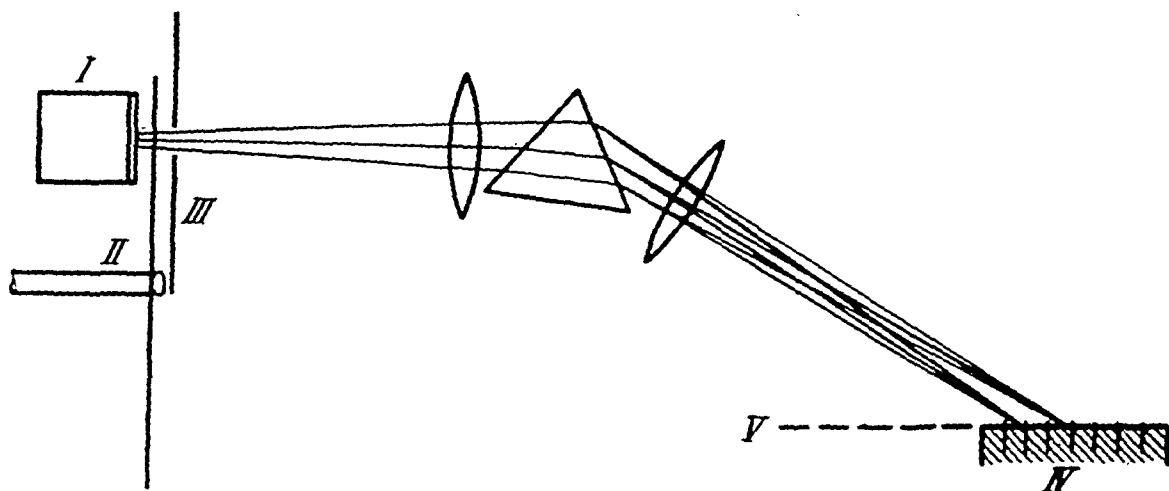


Fig. 3. Arrangement for spectral analysis of mitogenetic radiation. I. Source of radiation in chamber with quartz window; II. Rotating disk; III. Entrance slit of spectrograph; IV. Agar blocks with surface layer of yeast—blocks separated from each other by celluloid strips, and V. Plate holder. Newer experimental arrangements have a very well adjusted exit slit. (After Gurwitsch.)

radiation" is very important to the understanding of the mitogenetic radiation phenomenon.

Exceedingly dilute as well as highly concentrated suspensions have been reported to be successful. Crystalline quartz is reported to be most advisable, but substances such as thin glass plates and Japan lacquer sheets, which do not transmit or which transmit but little radiation between 1,900 and 2,600 Å. have been used successfully. The distance between sender and detector has been as little as a few millimeters or as much as a meter or more when an optical system is used. In the study of mitogenetic emission spectra, a distance of more than a meter has been used successfully in spite of the fact that considerable amounts of radiation are absorbed in the optical system (Hollaender, 6).

The time of exposure may be a few seconds or as much as 60 minutes. A more efficient way of adjusting the time has been interrupted exposure. Over-exposure will produce negative effects. It is customary to make several exposures of which at least one is to give the proper result.

counting method the effect can be determined after a few hours of incubation; in the mycetocrit method the effect can be determined only after incubation overnight.

Special precautions must be taken as to the condition of the sender, which must be such that it promises to be most reactive. To give typical examples, bacteria or yeast are good senders only when they are in their "log" phase, the phase of most active growth. Blood recovered from an animal can be mixed with a $MgSO_4$ solution and used at once, or it can be absorbed on filter paper, dried, and the filter paper torn and mixed with a few drops of distilled water and used at once for the detection. Deviations from this procedure are not advisable.

The description just given implies that the use of biologic detectors is a simple, well-outlined procedure and reproducible by anyone acquainted with fundamental biologic technic. Of the more than 700 publications on the subject, the majority definitely imply this. It is not necessary to give specific references here since in the abundance of material this point of

view is obvious. But I feel that such confidence is not justified, since this ignores the results of the group of workers who have not been able to repeat such work in spite of the fact that they have followed in the greatest detail the technic of the so-called "successful" workers. It also ignores the fact that "successful" workers have lately admitted that the detection methods in the hands of the most "successful" workers may give unreliable and at times negative results. Periods of inactivity of the biologic detectors sometimes last for a few days or weeks or months or in one case for years. Rahn (11) states in his book, "Invisible Radiations": "As a rule, the investigators do not discuss these periods of failure" He then gives a list of possible reasons for failure:

Disturbance of short radio waves (suggested by Gurwitsch).

Change in the sensitivity of the detector culture (Wolff and Ras).

Retarding effect of human radiation (Rahn).

Climatic changes.

Cosmic rays.

Sun-spots.

Terrestrial magnetism.

Other causes.

If we keep in mind these possible but apparently far-fetched explanations for negative results, we can see the difficulty of obtaining a clear-cut positive or negative decision on the existence of this radiation. Most investigators who have received negative results hesitate to publish their findings. In the last years three publications have appeared which I wish to discuss in greater detail.

Kreuchen and Bateman (10), working in Heidelberg, exposed liquid yeast cultures to typical mitogenetic senders, that is, yeast grown on agar; bacteria; pulp made of the medullar plate of the onion; pulp of sarcoma in Ringer solution, and glucose at 35° C. The experiments were conducted in large groups and in cases in which the number of these groups was not great, the number of duplicates in each group was

large and should have given positive results. But the authors concluded that no demonstrable effect was visible and they feel that if mitogenetic radiation exists, it must be below 3×10^2 quanta/cm.²/sec.

Westenberg (14), working in Amsterdam, attempted to repeat the work of Wolff and Ras. He co-operated with the Utrecht laboratory, learning the technic of handling slide cells and in every way co-operating with one of the most successful laboratories in Europe. His conclusion was that the slide-cell method gives too large an error and that the accepted positive results are not reliable. An exchange of cultures with the Utrecht laboratory took place but these cultures obtained from Utrecht were inactive. Westenberg concluded that the results of Wolff and Ras were, at least during the Summer of 1935, unreproducible.

Hollaender and Claus (8) in an extensive investigation tested in detail the mitogenetic effect. They used mainly bacteria as detectors, and in a smaller number of experiments, yeast. They investigated carefully the reliability of the bacteria for statistical investigation, the effect of a large number of factors such as light, temperature, previous history of the detectors and senders, medium for exposure, material of separating surfaces, distance between sender and detector, time of exposure, methods of treating the bacteria after exposure, etc. They give an abundance of statistical material and describe a large variety of senders. The conclusion of their investigation is that it is not yet an established fact that the existence of mitogenetic radiation is detectable by biologic materials.

I have been informed that M. N. Barnes, a former co-worker of Professor Rahn (2), attempted to repeat at the University of Rochester her own and Professor Rahn's experiments with yeast. No mitogenetic radiation was detectable.

The detection of mitogenetic radiation by physical means suggests itself. The only promising physical tool for the detection of radiation of an intensity approach-

ing that of mitogenetic rays is the modified Geiger-Müller counter first described by Rajewsky (7). A large number of attempts have been made to detect mitogenetic radiation by means of this instrument. Here,

of surfaces and occasionally finds one of sufficient sensitivity.

Barth (3), who first worked in Gerlach's laboratory in Munich and later worked in Gurwitsch's laboratory in Leningrad, gives

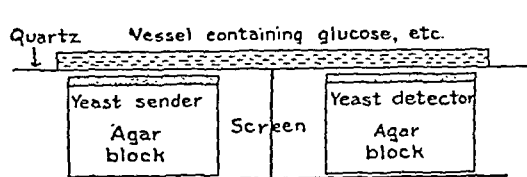


Fig. 4.

Fig. 4. Diagram illustrating mitogenetic induction through a secondary radiator.

Fig. 5. Spectral analysis of mitogenetic radiation from rabbit blood, and identification of the bands. (Redrawn from Golischewa.) G, Glycolitic spectrum; N, spectrum of peptid cleavages, so-called NH_3 spectrum; K, spectrum of creatin-phosphate cleavage; P, phosphatase spectrum; O, oxidation spectrum and ?, lines of unknown origin.

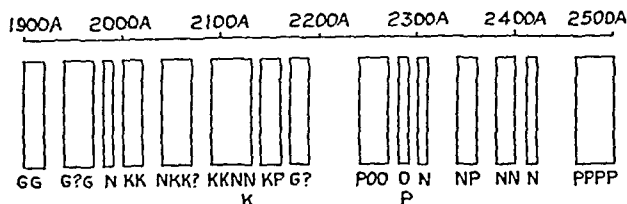


Fig. 5.

again, some of the investigators report success while some were unable to obtain uncontrovertible evidence that mitogenetic radiation can be recognized by the Geiger-Müller counter. A typical circuit and a Geiger-Müller counter are shown in Figure 5.

In all the work published on the Geiger-Müller counter, more or less the same circuit has been used although certain modifications have been made in the design of the cell as used by the different investigators. It is difficult to evaluate the results of these different tests and practically the only way to do this is to evaluate the sensitivity determination of the counters themselves. If these determinations are made in such a manner that no doubt can be cast on them, it is only necessary to repeat the work and to see whether duplicate results can be obtained.

It would lead too far to go into all the physical aspects of the work on the Geiger counter. It is sufficient to discuss the four latest publications on the subject. Audubert (1) uses the Geiger counter for the detection of radiation given up by chemical reactions. His sensitivity determination, as far as can be concluded from his experimental data on the subject, is open to serious criticism. He tries a large number

extensive tables showing clear-cut positive results with the Geiger counter. He used a variety of senders, but in all his extensive investigation he has not, until the date of this report, given any indication of his sensitivity determination. For this reason his results cannot be evaluated.

Siebert and Seffert (13), using a set of matched counters, reported in a number of publications definitely positive results. They, too, fail to give sensitivity determinations.

Hollaender and Claus (8), in a detailed study of the properties of the modified Geiger-Müller counter, made careful sensitivity determinations and have come to the following conclusions: The calibration of the counter indicates that the high sensitivity sometimes reported for the photoelectric surfaces used in these cells is greatly overestimated by many investigators. The counter used set an upper limit of 500 quanta/cm.²/sec. for mitogenetic radiation, this being about the limit of sensitivity of their counter.

It would appear from these results that at the present stage of the investigation it is not yet possible to conclude from the evidence brought by these physical detectors that the existence of mitogenetic radiation is proven by them.

Since mitogenetic rays are thought to be ultraviolet radiation of definite wave lengths, it should be possible to imitate them by means of artificial radiation of these same wave lengths. A few investiga-

of colony-forming organisms, followed by a period of retarded growth (Hollaender and Curtis, 9). The energy necessary to produce this effect is of an entirely different order of magnitude, *i.e.*, several million times

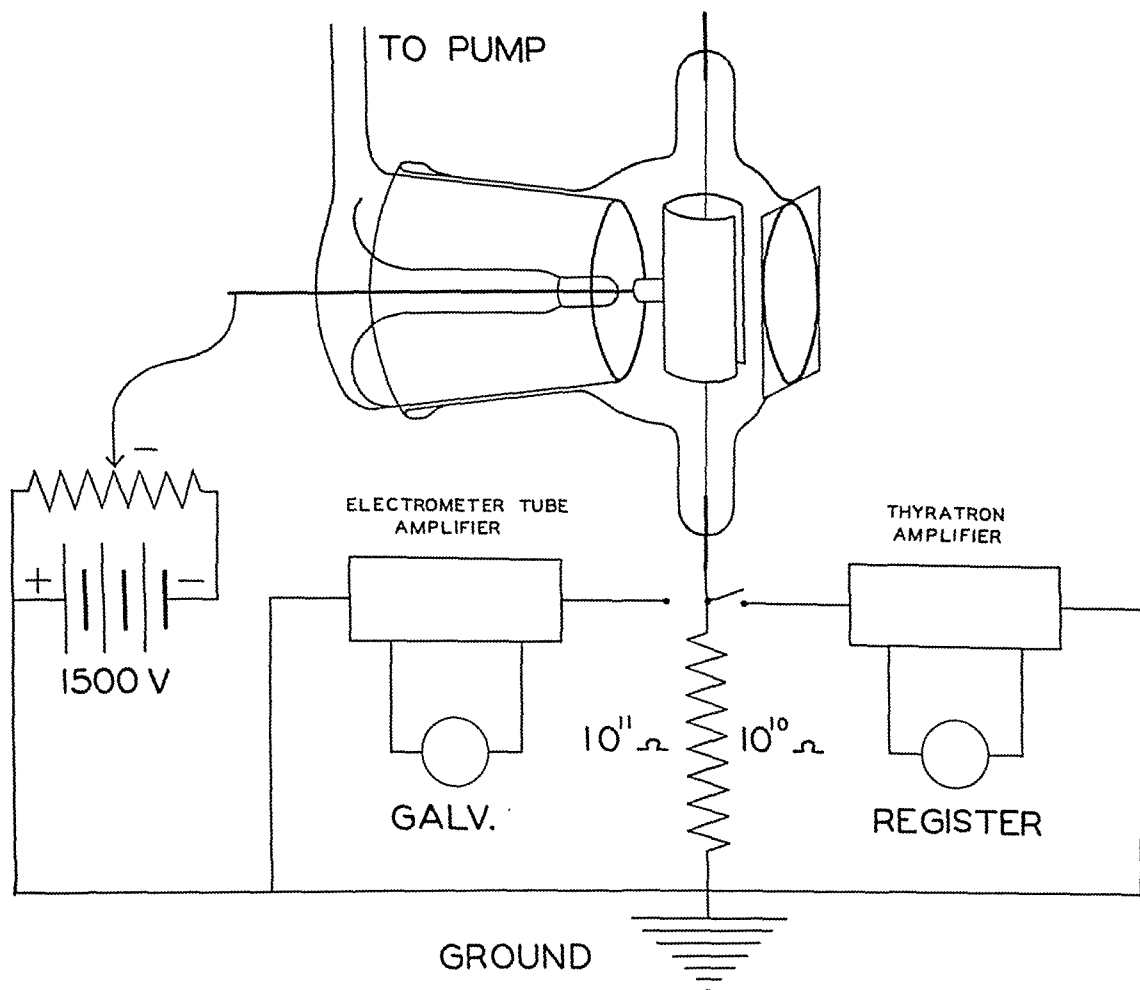


Fig. 6. Diagram of Geiger-Müller photon counter (G-M-III), with simplified accessory circuits.

tors have reported positive results by using artificial radiation, but there seems to be considerable evidence that ultraviolet radiation of proper wave length and of the intensity reported for mitogenetic radiation has no stimulatory effect. If we radiate bacteria or yeast with ultraviolet radiation of the proper wave length and sufficient intensity to kill a large percentage of the bacteria or yeast, the surviving organisms show, when transferred to a nutrient medium after irradiation, an apparent increase

that reported for mitogenetic rays. It would seem, then, that we are dealing here with a phenomenon of great importance to general radiation work, but of little direct significance to the mitogenetic problem.

If we look at the results of mitogenetic investigations on the basis of the discussion of detecting methods, we are surprised at the extent to which these methods have been used in the investigation of some of the most involved of biologic and chemical phenomena.

The most striking from the physical-chemical point of view is the analysis of mitogenetic spectra (Fig. 6). If we consider the weakness of the radiation which is emitted, it is interesting to note that there should be sufficient radiation left after passing through the spectrograph to be separated into a number of wave length bands!

Earlier publications on this problem report that blood of healthy persons will emit mitogenetic radiation; the blood of persons suffering with malignant tumors did not radiate. The tumor itself will radiate either when in contact with other tissues or when removed, minced, and mixed with a glucose solution. Later papers report that blood radiation also disappears or is weakened considerably as a result of starvation, heavy physical work, senility, or when serious diseases such as pernicious anemia, leukemia, scarlet fever, syphilis, pneumonia, or severe depression are present. In one of the latest publications Siebert (12) reports that radiation ceases when the blood of a healthy person is mixed with the blood of a cancerous person in the proportion of 1:1. However, radiation, in most cases, will not cease if blood of individuals suffering from other radiation-inhibiting diseases is mixed with blood from normal persons. When healthy blood of groups A or B is mixed, radiation stops, and when healthy blood of groups A or B is mixed with blood of groups O or AB, radiation continues (Siebert and Seffert, 13).

Extensive data have been reported in regard to nerve radiation. Spectrum analytical work shows typical mitogenetic spectra emitted by resting nerves, by the pulp of resting nerves, by nerves excited by incision, by emission at different distances from the point of electrical excitation, by emission at different distances from the point of mechanical excitation, by emission of radiation of the optic nerve excited by the illumination of the eye (Rahn, 11).

Extensive reviews on the application of mitogenetic analysis to many biologic problems are available (Gurwitsch, 5, Rahn, 11, and Siebert, 12).

We have shown that the methods of detection of mitogenetic radiation are not reliable in the hands of the most experienced investigators reporting positive results; *i.e.*, periods of ability to detect are interspersed with periods of definite failure. In the hands of other investigators the described methods consistently give negative results. I feel that we must conclude that the detection of these rays rests at present on an unsound basis. An evaluation of the results of the use of these methods must wait. For only after the detecting methods have been perfected can they be used as a truly scientific tool.

BIBLIOGRAPHY

- (1) AUDUBERT, R.: Sur Quelques Propriétés des Compteurs Photo-electriques. *Jour. d. Phys. et le Rad.*, 6, 451-456, 1935.
- (2) BARNES, M. N., and RAHN, OTTO: Tötung von Hefen durch Strahlungen des menschlichen Körpers. *Arch. f. Mikrobiol.*, 4, 583-588, 1933.
- (3) BARTH, HANS: Versuche zum physikalischen Nachweis von mitogenetischer Strahlung. *Arch. Sci. Biol. (Russian)*, 35, 29-34, 1934.
- (4) DECKER, GERTRUD: Ueber die Schärfe mitogenetischer Spektren. *Protoplasma*, 25, 515-527, 1936.
- (5) GURWITSCH, ALEXANDER, and GURWITSCH, LYDIA: Die mitogenetische Strahlung. Julius Springer, Berlin, 1932.
- (6) HOLLAENDER, ALEXANDER: The Problem of Mitogenetic Rays from "Biological Effects of Radiation", ed. by B. M. Duggar, McGraw-Hill Book Co., New York, 1936.
- (7) HOLLAENDER, ALEXANDER, and CLAUS, WALTER D.: Some Phases of the Mitogenetic Ray Phenomenon. *Jour. Optic. Soc. America*, 25, 270-286, September, 1935.
- (8) Idem: An Experimental Study of the Problem of Mitogenetic Radiation. *Bull. 100 Nat'l. Res. Council*, 1937.
- (9) HOLLAENDER, ALEXANDER, and CURTIS, JOHN T.: Effect of Sublethal Doses of Monochromatic Ultraviolet Radiation on Bacteria in Liquid Suspensions. *Proc. Soc. Exper. Biol. and Med.*, 33, 61, 62, October, 1935.
- (10) KREUCHEN, K. H., and BATEMAN, J. B.: Physikalische und biologische Untersuchungen über mitogenetische Strahlung. *Protoplasma*, 22, 243-273, October, 1934.
- (11) RAHN, OTTO: Invisible Radiations of Organisms. Gebr. Borntraeger, Berlin, 1936.
- (12) SIEBERT, WERNER W.: Die "mitogenetische" Strahlung des Bluts. *Handb. d. Allg. Hämatologie*, 2, 2, Urban and Schwarzenberg, 1934.
- (13) SIEBERT, WERNER W., and SEFFERT, HEINZ: Zur Frage der Blutstrahlung bei Krankheiten, insbesondere bei Geschwülsten. *Vorläufige Mitteilung. Biochem. Ztschr.*, 289, 292, 293, 1937.
- (14) WESTENBERG, J.: Die "Slide-cell" Methode von Wolff und Ras zum Nachweis von Gurwitsch-Strahlen. *N. V. Noord-Hollandsche Uitgeversmaatschappij. Amsterdam*, 1935.

THE VALUE OF THE X-RAY EXAMINATION OF THE SELLA TURCICA IN THE SAGITTAL POSITIONS¹

By DR. PEDRO L. FARÍÑAS, *Havana, Cuba*

IN June, 1937, we presented before the Internal Medical Society of Havana, "Estudios Clínicos," a paper related to the x-ray examination of the sella turcica in the sagittal projections, describing a new technic.

Although it is true that we have attained precision in the diagnosis of the alterations of the sella turcica as observed in lateral films of the skull, we believe that the sagittal views of the sella—antero-posterior and postero-anterior—add many interesting details of great value to the diagnosis. To the description of the technic and the information obtained in the examination of the sella turcica in these positions, we shall refer in this article.

When an anteroposterior film of the head is taken so that the central ray is parallel to a plane passing the frontal protuberance and the external auditory canal, the sella turcica will be projected in the foramen magnum (Fig. 1). In this film we can see the anterior clinoid processes, the upper part of the sphenoidal sinuses, and the dorsum sella with the posterior clinoid processes (Fig. 2).

When the postero-anterior film is taken so that the central ray is parallel to a plane passing through the external auditory canal and the frontal protuberance, we have the occipital projection (Fig. 3). In a film thus obtained, we can see the posterior clinoid processes, the dorsum sella, and the petrous portion of the temporal bone (Fig. 4). The lateral view of the head, taken routinely before the sagittal positions, will help us to find the point of election on the frontal bone through which the central ray should pass. We may draw a line on the film crossing the external auditory canal, the sella turcica, and the foramen magnum, that will leave

the frontal bone at the point of election (Fig. 5). The point thus selected at the frontal bone will vary according to the type of head. In the platybasia type it will be lower than in the normal head, while in the basal kyphosis it will be higher (Fig. 6).



Fig. 1. Patient in position for the frontal projection. The central ray is parallel to a plane passing by the frontal protuberance and the external auditory canal. The rod shows the direction of the central ray.

In order to obtain a diagnostic film, careful centering is necessary so that the view may be symmetrical. Also, the technical detail, such as a fine focus tube, long cone, and Bucky diaphragm, must be taken into consideration. A rod fastened to the cone shows the direction of the central ray, thus allowing the technician to change the inclination of the head, to

¹ Received for publication, September, 1938.



Fig. 2.

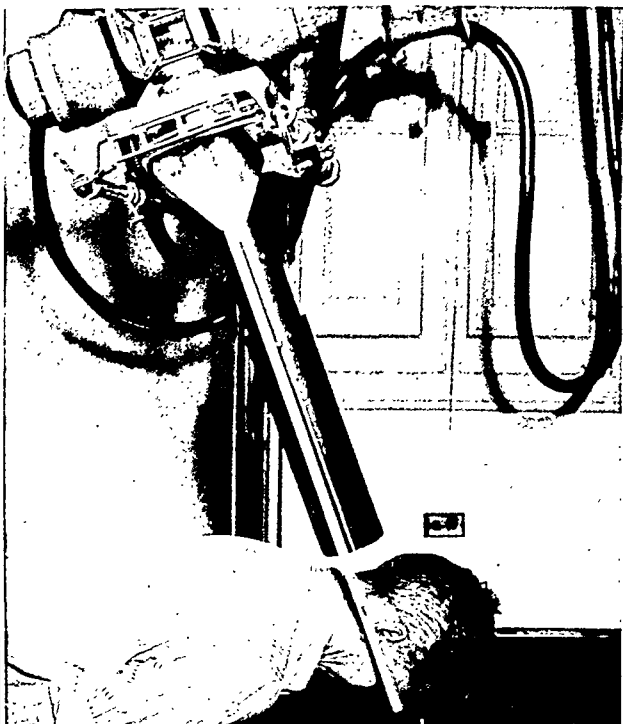


Fig. 3.

Fig. 2. Plate taken in the fronto-occipital projection. Here we may see the anterior clinoid processes, the dorsum sella with the posterior clinoid processes, and the central depression of the dorsum due to the bed of the hypophysis.

Fig. 3. Patient in position for the occipital projection. The central ray is parallel to a plane passing the frontal protuberance and the external auditory canal. The rod shows the direction of the central ray.



Fig. 4.

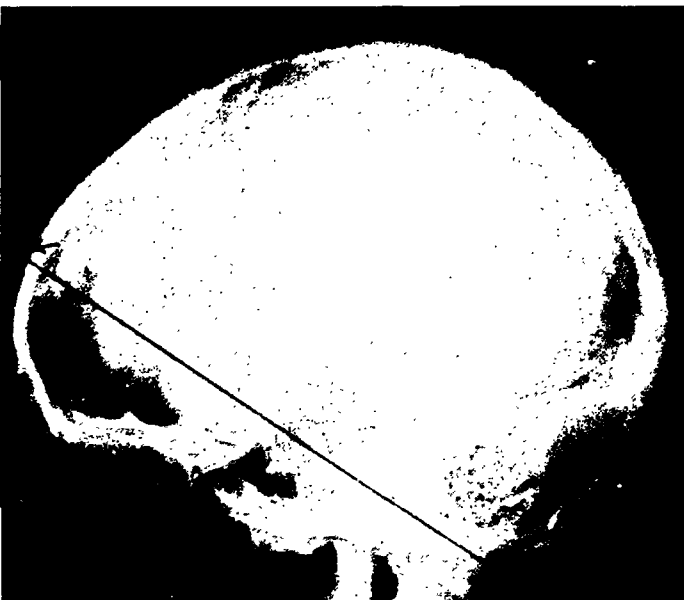


Fig. 5.

Fig. 4. Plate taken in the occipital projection. Here we may see the dorsum sella with the posterior clinoid processes.

Fig. 5. Lateral view of the head with a line passing through the sella turcica, the external auditory canal and the foramen magnum showing the point to be selected at the frontal bone.

make certain that the central ray is directed parallel to a plane that passes by the frontal protuberance and the external

and vertical diameters of the sella turcica measured in the lateral view and the transverse diameters measured in the sagittal

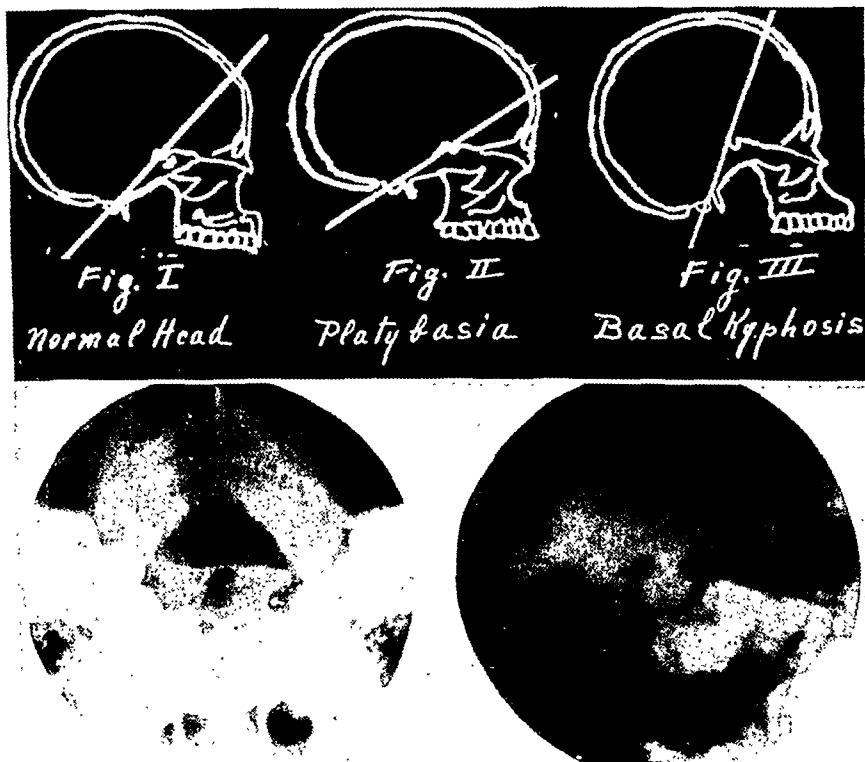


Fig. 6 (above). Schematic drawing showing the direction of the central ray in the different types of skulls.

Fig. 7 (below). C. M., white, 20 years old. Normal development until puberty; then she began to show evident signs of hyperpituitarism. She is very tall and presents amenorrhea. In the lateral view of the skull the sella appears normal in all its aspects. The diameters are within normal limits, there are no signs of atrophy of the dorsum, nor depression of the floor. The sagittal view shows a well localized zone of atrophy of the dorsum, extending to the right border.

auditory canal. We are now using 100 milliamperes-seconds with the fine focus of the rotating anode tube, 80 kv.p., at 40 inches distance, changing the kilovoltage according to the size of the head.

The transverse diameter of the sella turcica may be easily measured on the films taken in the sagittal projections, thus adding a new measurement to anteroposterior and vertical diameters of the sella obtained in the lateral view of the head. We have measured 50 normal sellas and found that the average transverse diameter is, in the male patient, 2 cm. and in the female patient 1.8 cm. It is of great interest to compare the longitudinal

projections. In the sagittal projection we have another view to observe, namely, the alterations that are produced in the sella turcica in cases of intracranial hypertension, intracellular tumors, the cerebral tumors situated in the middle cerebral fossa, and those situated at a greater distance from the sella which have been so well studied in the lateral films.

We will refer here only to the value of the examination in the sagittal projections of the sella turcica in cases of pituitary adenomas. We have cases of hyperpituitarism in which the sella is absolutely normal in the lateral position, while in the sagittal views we are able to see a well-

localized zone of atrophy of the dorsum sella which may be due to a small pituitary

described, we must always keep in mind the possibility of sellar anomalies. Usu-

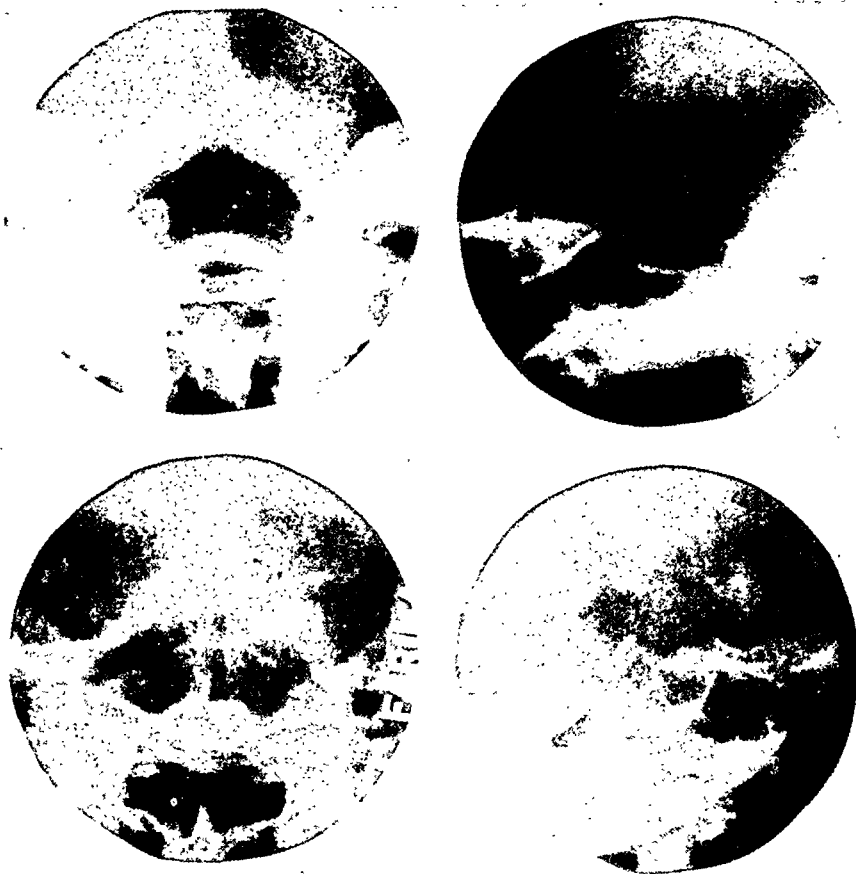


Fig. 8 (*above*). A. R., white, 45 years of age. During the last two years she has presented intense cephalalgia, asthenia, dizziness, nervous alterations, hypophyseal obesity. The campimetric examination shows the first phases of bitemporal hemianopsia (Dr. G. Alamilla). The lateral film shows slight atrophy of the dorsum. The sagittal view shows marked atrophy of the right half of the dorsum with partial destruction of the right posterior clinoid.

Fig. 9 (*below*). C. F., white, 59 years of age. Typical acromegaly. All symptoms have improved with hypophyseal radiation. The lateral view of the skull shows a large and deformed sella, with depression of the floor and marked atrophy of the dorsum. The sagittal view shows the atrophy of the dorsum with complete destruction of its right half.

adenoma that as yet does not show in the lateral view (Fig. 7). As soon as the tumor increases in size, the signs of compression appear and the sella begins to be deformed. The lateral view will show some atrophy of the dorsum sella and a slight depression of the floor. In the sagittal projection the atrophy or destruction of the dorsum sella, generally eccentric, will show very plainly (Fig. 8). When in the presence of changes in the dorsum sella, as the ones just

ally it does not show blurring at the edges, like that we see when in the presence of tumoral destruction, nor do we see the dense lines of osteal reaction caused by the adenomatous compression; the anomalies have, as a rule, exceedingly sharp and defined edges. If the tumor continues to grow, the destruction of part of the sella continues and may destroy half of the dorsum (Fig. 9). In acromegaly, we may see atrophy or destruction of half of the

dorsum sella, alternating with the condensation of the other half due to the

sagittal views, and they may even aid him in the selection of the route for operation.

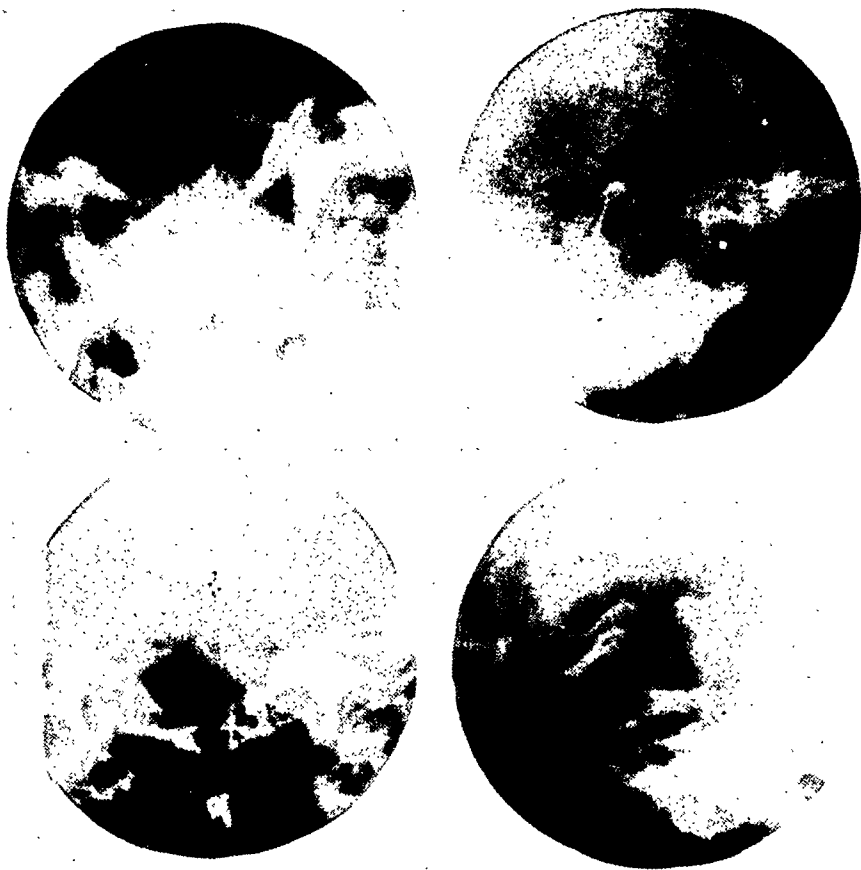


Fig. 10 (*above*). I. T., white, 35 years of age. Typical acromegaly with amenorrhea and severe cephalalgias. All symptoms improved by pituitary irradiation of three fields: two temporal and one frontal, each receiving 1,500 r. The lateral view of the skull shows a very large and deformed sella with marked depression of the floor. The sagittal view of the sella shows the destruction of all the lower part of the dorsum with condensation of its upper part.

Fig. 11 (*below*). R. P., white, 45 years old. Typical acromegaly. The lateral view of the skull shows a very large and deformed sella, with marked depression of the floor and atrophy of the dorsum. The sagittal view shows the extension of the tumor to the sphenoidal body and the middle cranial fossa on the left side with destruction of the anterior left clinoid process.

general condensation of the bones of the head (Fig. 10). If the tumor continues to increase, as is the rule, getting extremely large, the destruction of the sella may be more or less complete and the tumoral process may be seen extending into the neighboring structures (Fig. 11).

The surgeon may obtain better information of the tumoral extension from the

CONCLUSIONS

We believe that the radiographic study of the sella turcica in the sagittal projections adds a very important contribution to the signs that may be obtained in the lateral view. These signs are of the utmost importance in the radiotherapeutical and surgical treatment of the tumors of the hypophysis.

RETROPERITONEAL CYST WITH AGENESIA OF THE KIDNEY¹

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IN children, neither the presence of a retroperitoneal cyst, nor agenesis of a kidney, is a common occurrence. As a combined finding it has never been reported in a child, to our knowledge, and only once in an adult (1). The case herewith reported is of interest, not alone for its rarity, but more because it afforded a most difficult and puzzling diagnostic problem, as all such cases are prone to do. It is because of this practical aspect of the case that it is being recorded in the literature. The embryological implications arising from a study of this case also made it of more than usual interest.

M. W., female, born May 30, 1933, weighing 8 pounds 5 1/2 ounces, a product of apparently healthy Jewish parents. During the first six months of life she presented various feeding problems. At six months of age, vomiting became a conspicuous symptom, with recurrences in varying degrees of severity, until quite recently. The child was slow to sit alone, and the eruption of teeth first occurred at the age of 11 months. At 14 months of age, her weight was 22 pounds 5 ounces, the liver was palpable 3 cm. below the costal margin, and although the abdomen was slightly prominent, it was soft and not distended. When seen at 19 months, her weight was 25 pounds 3 ounces and she was in good general health. She suffered repeated upper respiratory infections, associated with otitis media and otorrhea. From the latter part of May to November, 1935, it was noted that the abdomen was becoming unduly large and although roentgen examinations of the abdomen and gastro-

intestinal tract were advised, these procedures were not consummated. When seen again in May, 1936, at the age of three years, the child's abdomen seemed even larger and roentgen examination was again advised.

The patient was admitted, on Sept. 29, 1936, to the Pediatric Service of Dr. Howard Childs Carpenter, at the Graduate Hospital, to determine the cause of the enlarged abdomen. On admission, the child was entirely symptomless. She was a poorly nourished, dark-complexioned girl, a little over three years of age. Her manner was pleasant, she was co-operative, and did not appear acutely ill. A tremendously enlarged abdomen made her quite conspicuous (Fig. 1). Hypertrichosis of the arms and legs was noted. There was no evidence of venous obstruction, and no manifestation of osseous rickets. The abdomen was pendulous when the child was erect, while in the prone position it gave the appearance of "running over" laterally, like an egg contained only in its sac. No discrete mass could be palpated but a distinct fluid wave was elicited and one obtained the impression of free fluid in the peritoneal cavity. The weight of this mass was evidently responsible for a moderately severe lordosis which resulted in a waddling gait. The greatest circumference of the abdomen was 25 inches. In other respects, the child's condition was good.

It is interesting to note the various diagnoses that were suggested as investigation of this patient progressed. The tentative diagnoses on admission were (1) Hirschsprung's disease, (2) atonia of the large bowel, (3) congenital anomaly of the abdominal musculature. Of the various diagnostic procedures resorted to, the

¹ Read before the Philadelphia Roentgen Ray Society, Nov. 4, 1937.

roentgen studies proved the most enlightening. Since the gastro-intestinal tract was suspected, a roentgen examination of this system was first requested.

Roentgen Examination (Oct. 1, 1936).—The chest was negative by fluoroscopic examination. The esophagus, stomach,

genital failure of rotation of the entire gastro-intestinal tract could not be excluded."

A roentgen examination of the colon by barium enema was done. The entire colon was in the left side of the abdomen, with a homogeneous area occupying the



Fig. 1.



Fig. 2.

Fig. 1. Appearance of the patient on admission to the hospital, showing the markedly protuberant abdomen.

Fig. 2. In the gastro-intestinal examination the stomach, duodenum, and small intestine were pushed up beneath the left dome of the diaphragm by a large mass in the right abdomen.

duodenum, and small intestine were negative for any organic lesion. The stomach, duodenum, and small intestine were crowded up beneath the left dome of the diaphragm by a large mass in the right abdomen (Fig. 2). There was a distinct hypomotility through the entire gastro-intestinal tract. At the 24-hour examination the cecum and appendix were clearly visualized in the upper left abdomen (Fig. 3).

"The abnormal position of the gastro-intestinal tract suggested displacement by a large abdominal mass, although a con-

right half (Fig. 4). No other abnormality was found in the colon. The conclusion was as follows: "Congenital failure of rotation of the right half of the colon. One must consider the possibility of a cystic mass of congenital origin producing the homogeneous appearance of the abdomen. The possibility of a renal tumor is suggested and an intravenous urogram is recommended."

Clinically the hirsutism suggested the possibility of an early adrenal tumor or ovarian cyst. Of special interest is the fact that at no time could a mass or tumor

be felt. According to one observer, the abdomen was like a "rubber balloon filled with egg white," flabby, soft, and running over the sides. Neither was there any definite signs of movable, uncontained

A urological consultant advised cystoscopy and retrograde pyelography.

Laboratory findings showed repeated urinalyses with specific gravity varying from 1.012 to 1.031. On the first few days



Fig. 3.

Fig. 3. At 24 hours the cecum and appendix were found in the upper left quadrant of the abdomen, with the remainder of the opaque meal in the descending colon.



Fig. 4.

Fig. 4. A barium enema showed the entire colon in the left abdomen.

fluid. It was also stated that "it is not conceivable that any soft-tissue tumor could possibly push loose and up into the left upper quadrant, the ascending colon and cecum from their normal anchorage."

From an intravenous urogram done on Oct. 6, 1936, the following conclusion was reported: "Evidence of slight compensatory hypertrophy of the left kidney in association with non-visualization of the right urinary tract (Fig. 5). Area of increased density involving the entire right half of the abdomen; possibilities to be considered are hydronephrosis with non-functioning kidney, Wilms' tumor, and congenital cystic kidney."

after admission, acetonuria was present. Blood counts, feces examinations, and blood chemistry were negative. T.P.R. were normal throughout the stay in the hospital.

A gastro-enterological consultant was of the opinion that first consideration should be given to a cyst of the right kidney, although a mesenteric, pancreatic, or ovarian cyst could not be excluded. He could detect no solid tumor mass or enlargement of the liver. He felt that a surgical exploration was indicated and favored an anterior approach, although this should be left to the surgeon.

A surgical consultant also advised ex-

ploration and did not feel that any additional information which might be obtained from cystoscopy would warrant the general anesthesia which would be required for this purpose.

neum. It extended roughly from the liver above to the pelvis below. The posterior peritoneum was opened and the cyst wall grasped. A suture was placed around an area which was then perforated with a



Fig. 5.

Fig. 5. An intravenous urogram showed non-visualization of the right kidney and ureter. There is a compensatory hypertrophy and hyperfunction of the left kidney.



Fig. 6.

Fig. 6. The retroperitoneal cyst removed at operation. When distended with air it measured $25.3 \times 23 \times 17$ cm.

The patient was discharged Oct. 9, 1936, because her parents wished to have her at home for two weeks before operation. She was re-admitted on Oct. 27, weighing 37 pounds 12 ounces. She was operated upon by Dr. Walter E. Lee on Oct. 30, 1936.

Report of Operation.—The pre-operative diagnosis was abdominal cyst arising from the right ovary or from the mesentery. The operation consisted of an excision of a retroperitoneal cyst. The anesthesia used was 85 mg. avertin per kilogram of body weight, and ether. Right paramedian incision 10 cm. in length, reaching from the right costal margin to nearly the horizontal ramus of the pubis. The cyst could be seen as a large bluish-colored sac filled with fluid, situated behind the perito-

trochar and cannula and the cyst evacuated of approximately 2,500 c.c. of straw-colored fluid. The cyst was then bluntly separated from the posterior parietal structures, by exposing the aorta from the margin of the renal vessels down to the sacrum and then the vessels of the pelvis down to the rectum. All of the blood vessels which were attached to the wall were ligated with black silk. At the lower end of the cyst wall the right fallopian tube and ovary were separated and replaced in the pelvis. The right kidney and ureter were not encountered. As with all retroperitoneal cysts, there was no actual pedicle and as a result many blood vessels required ligation. The post-operative diagnosis was retroperitoneal cyst.

Gross Pathologic Examination (by Eu-

gene A. Case, M.D.). The cyst when distended with air measures $25.3 \times 23 \times 17$ cm. (Fig. 6). The wall is of paper thinness and in the preserved state resembles parchment. The inner surface is smooth.

albumin, 0.504 per cent; globulin, 0.617 per cent; ratio, 1:08.

Microscopical Examination.—"The wall of the cyst is thin, composed of dense fibrous tissue and lined with flat unidenti-



Fig. 7.

Fig. 7. A barium enema done after operation shows the colon in practically its normal position.



Fig. 8.

Fig. 8. The patient before and after operation.

Attached to the outer surface is a small, soft, bean-shaped structure measuring 2.5 cm. long, 1.5 cm. wide, and 1 cm. thick. It is brownish and at one pole there is a small cyst. The cut surface reveals typical kidney structure. No kidney pelvis and ureter appear to be present though the organ is well formed otherwise but diminutive in size. It is possible that the pelvis has been destroyed or compressed by the growing cyst.

Fluid in the Cyst.—Total volume received, 2,500 c.c.; specific gravity, 1.008; non-protein nitrogen, 34 mgs. per 100 c.c. of fluid; total protein, 1.12 per cent;

fied cells. Loose areolar tissue carrying blood vessels and infiltrated with scattered leukocytes is attached to the outer surface of the cyst. In the medulla of the kidney there are more or less rounded spaces, much larger than tubules, lined with broad columnar cells. These spaces probably represent an atypical pelvis and calices though they are not lined with transitional epithelium. They are not normal in their arrangement though the rest of the kidney is apparently normal except for its small size, the presence of a coagulum in a few of Bowman's capsules, and a collection of lymphocytes in one area."

The patient's recovery was rapid and uneventful. Although the right kidney and ureter had not been felt at operation, it was not known for a certainty whether or not these organs were present, therefore, on Nov. 18, 19 days after operation, re-examination of the urinary tract by means of intravenous urography was done. This again showed, "non-visualization on the right side. The left pelvis and ureter present an appearance quite similar to the previous examination. There is again evidence of compensatory hyperfunction on the left side. The bladder still presents an appearance suggesting that it is being pushed to the left."

Before operation it was thought that the non-visualization on the right side was due either to a temporary cessation of function or complete destruction of the kidney. It was hoped that, after operation, the right kidney would be visualized, indicating a return of function. Failure to visualize the kidney made it necessary to consider repetition of the intravenous urogram at some future time.

Since a congenital failure of rotation of the gastro-intestinal tract had been considered before operation, it seemed advisable to repeat the roentgen study post-operatively. At this examination the various portions of the digestive tract were found to have returned to their normal position with the exception of the cecum which was somewhat higher than normal (Fig. 7).

The patient was discharged from the hospital in excellent condition on Nov. 21, 1936 (Fig. 8). She has been under observation by one of us (J. A. R.) since that time and has done exceedingly well. On May 12 of the following year the intravenous urogram was repeated and reported as follows: "Re-examination by means of intravenous urography presents essentially the same appearance found in our previous examinations. There is non-visualization on the right side. Attention is called to two additional congenital defects, namely, non-rotation of the left kidney and marked

widening of the symphysis pubis, both of which were present but not mentioned in our previous reports."

In view of the abnormal development at the symphysis pubis roentgen studies were made of various epiphyses. No other abnormality in epiphyseal development was found.

Since the studies to date indicated an absence of the urinary organs on the right side it was considered advisable to have a cystoscopic examination of the bladder. Accordingly this examination was performed by Dr. L. F. Milliken on May 14, 1937, with the following report: "The bladder was negative. The two sides of the trigone were perfectly normal and identical in conformation. There was, however, absence of the right ureteral orifice."

It seemed justifiable, from the accumulated evidence, to conclude that the large retroperitoneal cyst had arisen in the right kidney, the direct result of some congenital anomaly of development.

DISCUSSION

True retroperitoneal tumors are those lying in the retroperitoneal fatty tissue, not arising in an adult organ, and which are attached to the surrounding structures only by areolar tissue (2). Such tumors may be either solid or cystic. Retroperitoneal tumors of urogenital origin have been reported as possessing glomeruli, renal tubules, rete structures, bone, hair, sweat glands, fat, smooth muscle, uterine mucosa, and chorion epithelium. Embryologically, this conglomeration of histopathology can be adequately explained on a common basis, namely, their derivation from remnants of the embryonal urogenital system (3). We will confine our discussion to the cystic tumors of the retroperitoneal space.

Retroperitoneal cysts have been variously classified, but from an embryological-anatomical standpoint, the following classification by Handfield-Jones (2) seems most adequate.

1. Cysts of urogenital origin.
 - (a) Pronephric.
 - (b) Mesonephric.
 - (c) Metanephric.
 - (d) Müllerian.
2. Mesocolic.
3. Cysts arising in cell inclusions—teratomatous cysts.
4. Lymphatic cysts.
5. Traumatic blood cysts.
6. Parasitic cysts.
7. Developmental cysts in fully formed organs.
 - (a) Kidney.
 - (b) Pancreas.

Many of these terms are self-explanatory. Retroperitoneal cysts may sometimes be difficult to differentiate and classify even after operation and histopathological study. The developmental cysts are usually unilocular, with smooth, fibrous surface, with or without a lining epithelium, and contents usually of a straw-colored, albuminous fluid of low specific gravity. Although the presence of primitive glomeruli and kidney tubules in the cyst wall definitely proves these cysts to be of urogenital origin, it is not held as a necessary criterion in their diagnosis (4).

The presence of both a retroperitoneal cyst and agenesis of the kidney are apparently inextricably bound in their etiological basis, and by briefly reviewing kidney embryology (5, 6, 7, 8, 9) this association may in some degree be elucidated.

The urinary system has its origin in common with the reproductive system in what is known as the urogenital fold, located on the posterior wall of the trunk of the embryo (Fig. 9). All embryonal kidney types are composed of a conglomeration of tubules, which have not only a common origin but to a considerable extent the same architecture. In the cephalic part of the urogenital fold there is early differentiated a system of tubules comprising the most primitive kidney, known as the pronephros (Fig. 10). It is also referred to as the "head" kidney, because of its position, and is retained as a permanent excretory organ in such adult

forms as amphioxus and certain lampreys. It is noted in the human embryo in the 1.73 mm. stage, but soon degenerates, concomitantly with the development of a second, larger, and more complicated system of tubules, situated more caudad and known as the mesonephros. The only portion of the pronephros to remain is its main excretory duct, which passes downward to become continuous with the excretory duct of the mesonephros. This duct, known as the mesonephric or Wolffian duct, passes caudally to communicate with the cloaca (Fig. 10). The mesonephros likewise develops from the urogenital ridge and is first noted in the 2.5 mm. embryo. It is retained as the permanent excretory organ of larval fishes and amphibians. In the human embryo, it apparently has a temporary function, but its excretory tubules and corresponding part of the collecting duct subsequently become further modified to establish connection with the genital gland. Thus it becomes an integral part of the reproductive system.

The permanent kidney, or metanephros, arises in the pelvis from the caudal end of the urogenital fold. Its structure is similar to that of the mesonephros, being composed primarily of tubules. In the caudal end of the mesonephric or Wolffian duct, just before it joins the cloaca, the duct makes a sharp turn and at this bend there arises a small outgrowth which develops into the ureteric bud (Fig. 10). This enlarges in the direction of the metanephros and gives origin to the ureter, pelvis, and collecting tubules. The free end of the ureteric bud expands to form the renal pelvis. This pelvic dilatation grows into the metanephros which has become separated from the more cranial portion of the urogenic ridge. As the ureter elongates, the pelvic portion surrounded by the metanephrogenic blastema ascends until, in the six-weeks embryo, it has reached the normal position of the kidney, opposite the second lumbar vertebra (Fig. 9). The glomeruli and secretory tubules are derived from the metanephrogenic blas-

tema, while the collecting tubules, calices, pelvis, and ureter are derived from the ureteric bud.

The embryological development of the upper urinary tract, as outlined above,

rogenic blastema forms a cap about the primitive pelvis and, as the pelvis grows cephalad, the former is carried along with it, both developing and differentiating as the combined mass takes its definite

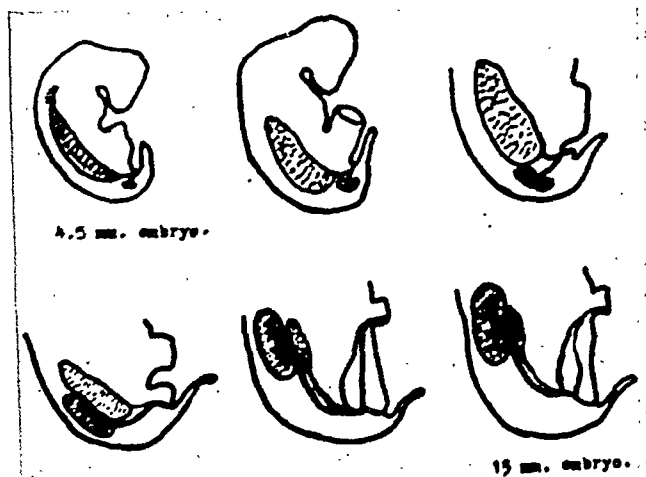


Fig. 9.

Fig. 9. Schematic diagram showing the urogenital fold on the posterior wall of the trunk of the embryo, the formation of the kidney from the metanephros and its ascent to its normal position opposite the second lumbar vertebra.

Fig. 10. Schematic diagram to show the relationship of the pronephros, mesonephros, and metanephros.

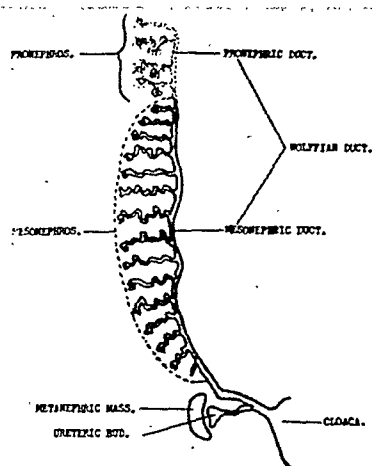


Fig. 10.

permits many possibilities for anomalies to occur. Failure of certain portions of this system to develop, interference with growth by constriction from blood vessels and other adjacent structures, account for many of the anomalous conditions to be found in the adult urinary system. To enumerate and describe the origin of the many anomalies that may occur is beyond the province of this contribution. Attention will be confined to the factors involved in producing the retroperitoneal cyst with agenesis of the kidney occurring in the patient whose case history forms the basis of this report.

Should the ureteric bud not reach the metanephros, the differentiation into pelvis, ureter, and tubules does not occur, and the upward migration of the kidney is not possible. In fact, the differentiation of the metanephrogenic blastema depends upon the presence of branches of the ureteric bud. Normally, the isolated metaneph-

position in the retroperitoneal tissue opposite the second lumbar segment (Fig. 9). Should the ureter not reach the blastema, the differentiation and migration are not possible. When the ureter is absolutely absent, there is no trace of its opening into the bladder, and the trigone is reduced to half its normal size. Nicholson (8) prophesied that the trigone will be natural in size and shape if the ureter has been obliterated and reduced to a thin cord, so that it is conceivably undemonstrable and the opening into the bladder obliterated. Although Nicholson had no evidence of this occurrence, the facts as presented in our case could very readily fulfill this prophecy. Should the ureter not reach the blastema various possibilities may occur. The blastema may disappear or may remain as a "cell rest" which may either undergo solid or cystic tumor formation.

As to the origin of the large cyst, Kamp-

meier's (9) observation on fetal kidneys is of considerable interest. He has shown that in the normal development of the kidney numerous small cysts occur. In the process of formation of the collecting tubules, as growth of the cellular elements of the kidney occurs, these small cysts are pressed upon and thus obliterated. However, it is not uncommon for a number of them to remain as permanent cystic structures in the kidney. Occasionally, such a cyst may grow to considerable size and assume clinical importance. This is apparently the origin of the cyst in our case. With increase in size of the cyst, there was obliteration of the pelvis and ureter, with failure of the kidney to continue its growth. As the cystoscopic examination showed the trigone to be normal on both sides, it is inferred that the ureter reached the nephrogenic blastema and migrated with it to about the normal position of the kidney. Subsequently, however, with incomplete differentiation in some structure of the kidney, a cyst formed and continued to receive secretion from that portion of the kidney which remained. As the cyst enlarged, atrophy of the ureter and obliteration of the ureteral orifice of the bladder occurred.

The problem of diagnosis in such cases is one solved chiefly by exclusion. To be differentiated are hydronephrosis, ovarian or mesenteric cyst, and cysts in other intra-abdominal organs. Of considerable aid are the roentgen examinations of the gastro-intestinal and urinary tracts and cystoscopy with retrograde pyelography. Retroperitoneal cysts are usually asympto-

matic and rarely obstruct internal organs, but may displace them. The marked expansibility of the abdominal wall probably accounts for the absence of obstructive phenomena. The hypertrophy of the opposite kidney is in accord with expectation in cases of solitary kidney. It is noteworthy that there was remarkable and rapid improvement in the child's general condition following operation, although the lordosis and waddling gait persisted. She became quite obese, with fat distribution characteristic of hypopituitarism.

SUMMARY

A case of agenesis of the kidney with retroperitoneal cyst is reported, with comments on the embryological implications of this associated anomaly.

BIBLIOGRAPHY

- (1) KRAUSS, L. W., and STRAUS, REUBEN: Retroperitoneal Cyst Arising in Persistent Metanephros with Congenital Absence of Right Kidney and Ureter. *Jour. Urol.*, 34, 97-105, August, 1935.
- (2) HANDFIELD-JONES, R. M.: Retroperitoneal Cysts: Their Pathology, Diagnosis, and Treatment. *British Jour. Surg.*, 12, 119-134, July, 1924.
- (3) HANSMANN, G. H., and BUDD, J. W.: Massive Unattached Retroperitoneal Tumors. *Am. Jour. Path.*, 7, 631-673, November, 1931.
- (4) CAVE, H. W.: Retroperitoneal Cysts. *Surg., Gynec. and Obst.*, 41, 617, November, 1925.
- (5) AREY, L. B.: *Developmental Anatomy*, 239. W. B. Saunders Co., Philadelphia and London, 1934.
- (6) FRAZER, J. ERNEST: *A Manual of Embryology*. William Wood & Co., New York, 1932.
- (7) KEIBEL and MALL: *Manual of Human Embryology*. Vol. 2. J. B. Lippincott Co., Philadelphia and London, 1912.
- (8) NICHOLSON, G. W.: The Kidneys and Development. *Guy's Hospital Reports*, 77, 362, 1927.
- (9) KAMPMEIER, O. F.: A Hitherto Unrecognized Mode of Origin of Congenital Renal Cysts. *Surg., Gynec. and Obst.*, 36, 208-216, February, 1923.

SOME HISTOLOGICAL TUMOR VARIANTS AND THEIR INFLUENCE UPON RADIOSENSITIVITY¹

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WITH the establishment of the radiation treatment of cancer has come a series of problems relating to the pathology of tumors and the technic of irradiation. Chief of these are the avoidance of overdosage and the likelihood of response of a given tumor to the amount of radiation to be delivered to it. Both of these problems are related to radiosensitivity, or the response of different tumors to a graded series of roentgen unit doses.

By the term radiosensitivity of a growth is meant its probability of resolution and cure under radiation therapy. Unfortunately, in clinical practice at the present time radiosensitivity is used to signify both the diminution in size of a tumor and the killing of it. Only in exceptional circumstances is the ability to reduce the size of a growth without killing it of anything more than academic interest in relation to the patient and his prognosis. Therefore, the term radiosensitivity will be used here as synonymous with radiocurability, denoting the ability to eliminate growth from a given treated area, and not having any relation to alteration in size *per se*.

Work over a number of years, from that of Regaud and his co-workers (1) to the present time, has established the radiosensitivity of different normal tissues and most of the histologic classes of cancer. As a general rule it has been found that the lethal dosage of a tumor is less than that of its parent tissue, and use is made of this knowledge in the avoidance of radiation necroses.

It is a principle of radiation therapy that the basal-cell carcinoma is more radiosensitive than that of squamous origin,

and that the squamous carcinoma, in its turn, is more sensitive than the columnar-cell carcinoma. Similarly, the relative lethal doses of some other types of tumor, such as lymphosarcoma and seminoma, are fairly well known. While within limits the different classes of tumor tend to maintain their specific lethal dosage, yet exceptions are frequent. What is considered to be a resistant growth may disappear under palliative treatment, while a usually sensitive tumor may prove entirely resistant. These variations from the normal are a constant source of worry to the radiotherapist, particularly with regard to the abnormally resistant growths, in which a knowledge of the probability of resistance would indicate surgical treatment.

It is of considerable importance, then, to be able to judge from the histology of a tumor whether it is likely to be typical of its class as regards radiosensitivity. As yet, no reliable criteria of radiosensitivity have been established, and the usual practice among pathologists is to assess the sensitivity of a tumor according to the degree of anaplasia it shows.

In approaching the problem of the variation in sensitivity of tumors of the same genesis, an attempt has been made to correlate the histology of a large series of tumors with their clinical response to irradiation.

MATERIAL

The material for this investigation was obtained in the pathologic laboratory of a cancer hospital in which approximately 2,000 new patients are seen each year. Of those patients selected for radiation therapy, biopsy material was available from about 1,100 each year for five years, giving a total of some 5,500 sectioned tu-

¹ Part of a thesis approved for the Degree of Doctor of Medicine in the University of London.

mors from which to identify the radio-therapeutically atypical.

The atypical was sought from two direc-

into account, and no five-year survival rates have been estimated. In dealing with five-year figures such factors as intercur-

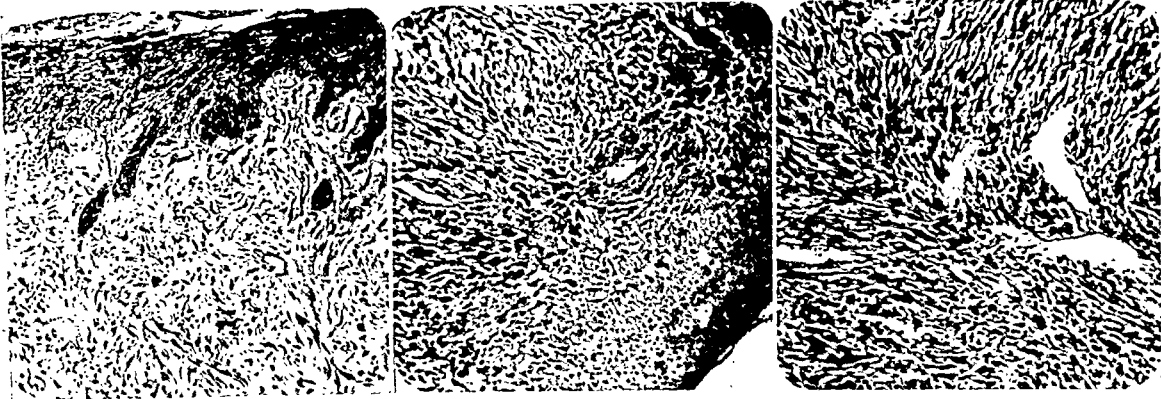


Fig. 1.

Fig. 2.

Fig. 3.

Figs. 1, 2, and 3. Spindle-cell carcinoma of squamous origin at six-month intervals. (H. and E. $\times 100$.)

tions. In the first place, any patient showing an abnormal response to treatment had his sections examined in the light of this response. Secondly, when any tumor showed a deviation from the typical histologic picture the patient was followed closely to see if this deviation could be correlated with an abnormal response to therapy. By this means a considerable series of tumors became available for study.

The bulk of the material referred for treatment consisted of growths of squamous- or basal-cell origin, from skin, mouth, pharynx, or cervix. The remainder constituted a fairly representative series of growths, with the exceptions that tumors of the thorax, abdomen, and brain were practically non-existent.

All superficial tumors were biopsied when first seen. It has been a rule of the hospital that no biopsy should be performed through intact skin, so that, with few exceptions, biopsy from deep-seated tumors was not carried out unless superficial ulceration had occurred. This means, of course, that the number of tumors such as sarcoma and breast carcinoma is small. Some postmortem material has been available to supplement these numbers.

In assessing response to irradiation the clinical observations alone have been taken

rent disease, League of Nations staging, and the presence of obvious or occult metastases must be considered, and it is felt that such factors, while undoubtedly influencing the survival rate, have little to do with the actual response to irradiation of the primary tumor. Accordingly, case note annotations such as "clinically well" and "clinically poor response," appearing after six months, have been assumed to refer to sensitive and resistant growths respectively.

The various observations made will be considered under separate headings of cell type and situation.

1. *Squamous-cell Carcinoma*.—The majority of these tumors appeared to be of medium sensitivity, but some variant groups were recognizable histologically.

A. The spindle-cell epithelioma has occurred frequently, and has nearly always proved to be a resistant tumor. In this material there were primary and secondary types. The primary type was found in normal situations and was not associated with any other disease. Four of these tumors were studied; all proved entirely resistant to irradiation, and appeared to be slower growing and slower to metastasize than the normal squamous type. Figures 1, 2, and 3 show one of these growths at

six-month intervals. This occasioned a fair amount of pathologic discussion before the diagnosis of spindle-cell epithelioma

The secondary type of spindle-cell epithelioma occurred invariably in association with lupus. Here it was felt that the

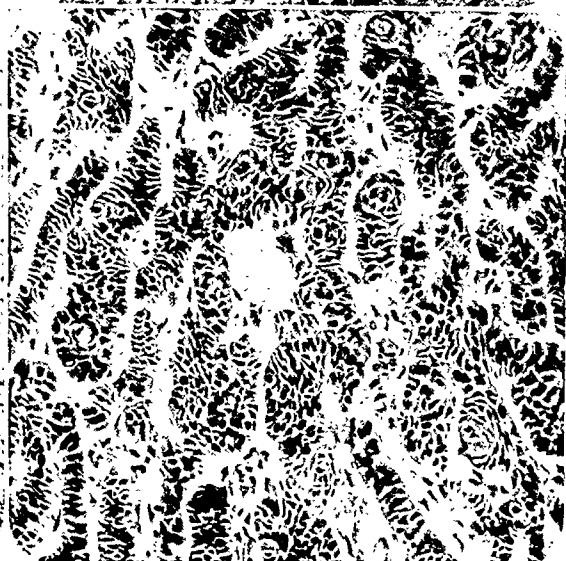
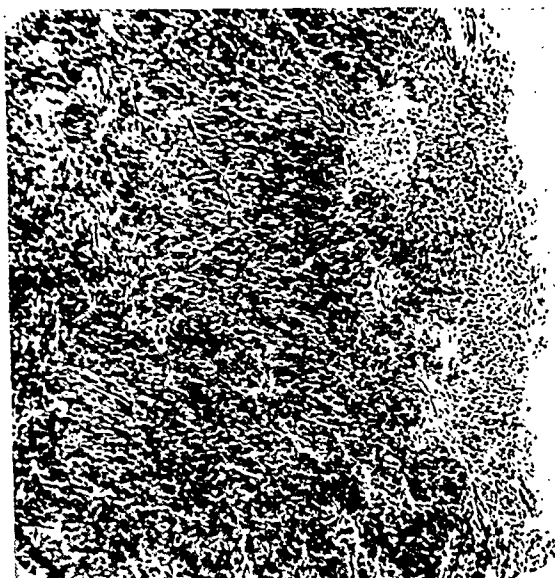


Fig. 4 (*upper left*). Transitional-cell carcinoma of esophagus. (H. and E. $\times 80$.)

Fig. 5 (*upper right*). Secondary transitional-cell carcinoma in cervical tissues, from a facial primary. (H. and E. $\times 80$.)

Fig. 6 (*lower left*). Squamous differentiation in a basal-cell carcinoma. (H. and E. $\times 100$.)

Fig. 7 (*lower right*). Minute areas of keratinization in an atypical basal basal-cell carcinoma. (H. and E. $\times 150$.)

was decided upon. Irradiation had no effect upon the progress of the growth, although it will be seen that in successive biopsies the appearances suggest more and more a spindle-cell sarcoma.

spindle form was due to the mechanical effects of the tumor bed. Whether the resistance of this tumor is due to the influence of the tumor bed or to the cytologic morphology is not yet clear, but 11 of 16

in this group were entirely unresponsive to irradiation, while three of the remainder recurred within six months.

mous carcinomas is seen in the lympho-epitheliomas of Schmincke and Regaud (2, 3). This diagnosis was made six times

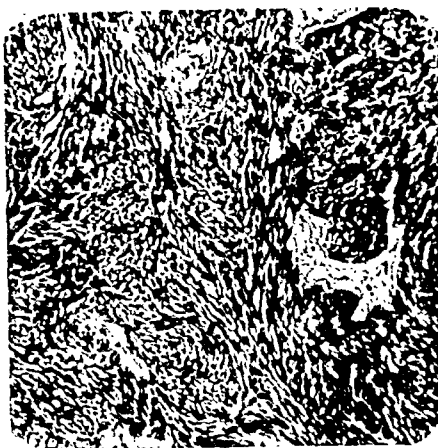


Fig. 8.

Fig. 8. Post-irradiation basal-cell carcinoma showing a spindle cytology. (Weigert's hematoxylin and van Gieson. $\times 100$.)

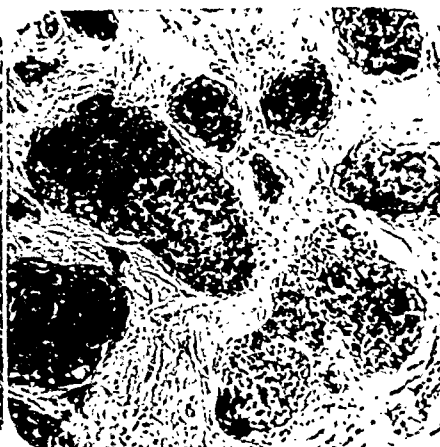


Fig. 9.

Fig. 9. Tricho-epithelioma. (Iron hematoxylin and van Gieson. $\times 80$.)

Minor degrees of spindle-cell formation, such as occurs so frequently in otherwise normal epitheliomas of the penis and vulva, appeared to have no effect upon the radiation prognosis.

B. An analogue of the epithelioma on lupus was seen in the epitheliomas of the tongue in association with syphilis. Of a series of some fifty-odd of these cases, about one-half proved to be unduly refractory to irradiation. In these cases the spindle-cell formation seen in lupus was little in evidence, a fact which suggests that the tumor bed may play a bigger part in growth resolution than has been commonly accepted.

C. An analysis of 200 consecutive cases of squamous-cell carcinoma revealed no correlation of radiosensitivity and differentiation. In other words, no significant difference was noted between the responses of keratinizing and anaplastic tumors. This observation is contrary to the usually accepted dictum that the more anaplastic a growth the more sensitive it is to irradiation. The only exception is dealt with next.

D. The most extreme anaplasia in squa-

in the present series, and each of the tumors proved highly radiosensitive in contrast to the moderate sensitivity of the usual epithelioma. On reviewing the histology of these six cases, it was felt that the diagnosis could stand unquestioned in only two, as a tumor of the lymphocyte series seemed as good a diagnosis in the remainder.

Many of the lymphosarcomas are as sensitive as the lympho-epitheliomas, so that the extreme radiosensitivity of the latter does not constitute a pathognomonic feature. In view of the difficulty in diagnosis of these tumors, and the fact that they resemble lymphosarcoma so closely, one is inclined to agree with the opinion expressed by Dawson, Harvey, and Innes (4) that many, if not most, of the histologically diagnosed lympho-epitheliomas are in reality lymphosarcomas.

E. A further subdivision of the squamous carcinoma has become evident and has been designated transitional-cell carcinoma. As the name implies, the growth shows a cytology midway between basal and squamous cells. Morphologically the cells tend to lie in clumps with a palisaded edge, and some have been misdiagnosed as

basal-cell carcinomas, the true state of affairs being recognized only on the examination of metastases.

Apart from the uterine cervix and bladder, 10 of these cases have been met with: four in the esophagus, four in the mouth, and two in the skin of the face and buttock, respectively. They were all characterized by their marked radiosensitivity and early metastases.

The esophageal cases were all examined postmortem and in every instance the primary growth was cured both macro- and microscopically. Distant secondary deposits were present in all four cases. Figure 4 shows the histologic features of one of the primary growths. Figure 5 shows the appearances in a cervical lymph node, from a patient whose tiny primary lesion of the cheek was diagnosed, from biopsy material, as basal-cell carcinoma.

F. Two cases of Bowen's disease in this series showed radioresistance, thereby confirming Ewing's opinion on the matter. The point is worthy of emphasis since many radiotherapists believe the condition to be sensitive.

2. *Basal-cell Carcinoma*.—With the exception of the highly sensitive growths, such as seminoma and thymoma, the basal-cell carcinomas are the most sensitive of the routine therapeutic problems. They present so many morphologic variations, however, that one is forced by experience to be extremely chary of using the word "typical" when referring to them. Tumors microscopically indistinguishable from basal-cell carcinoma have been assumed to have a varying genesis, and occasionally by some feature of differentiation they betray the possibility that they will not behave characteristically when subjected to irradiation. Certain of these features have been identified, and will be considered separately.

A. Of the recurrent basal-cell carcinomas, the majority show in the primary section areas of keratinization or prickle-cell formation. Apparently, directly any sign of squamous differentiation occurs, however slight, the sensitivity of the tumor as

a whole is changed from basal- to squamous-cell standards. In many of the early experimental papers on minimum lethal dosage, the work was vitiated by the failure to realize the significance of this squamous differentiation.

In reporting on such tumors, comment is always made on any squamous features, however slight they may appear. Figure 6 shows an island of squamous differentiation in an otherwise regular basal-cell tumor, from a patient whose lesion proved atypically resistant. Figure 7 shows minute areas of keratinization in a morphologically rather unusual type of basal-cell carcinoma which proved similarly resistant.

B. While in most types of cancer each succeeding recurrence tends to be more anaplastic than the previous one, the post-radiation recurrent basal-cell carcinoma shows the same morphology but the cells assume a definite spindle shape as is seen in Figure 8. Twenty-eight of these tumors were studied, and 22 of them were eventually excised surgically. These figures indicate that if such recurrent tumors show a spindle cytology they should be referred to surgery immediately, before the surrounding tissues have been further devitalized by more irradiation.

C. There were few basal-cell variants to which a definite label could be attached. One syringoma and two tricho-epitheliomas were identified, and all proved refractory to irradiation. Figure 9 is a photomicrograph of an original tricho-epithelioma which has never disappeared during the three years it has been under observation. It has had two full courses of irradiation, as well as various other treatments, and successive biopsies show a less well defined follicular arrangement and a more malignant appearance.

D. The last group of atypical basal-cell carcinomas is comprised of those which produce cysts. The question of nomenclature is at present in a vague state, and usually such names as "epithelioma adenoides cysticum" and "adeno-epithelioma" are applied to them. Histologic precision

has not been attempted, and the tumors have all been labelled cystic basal-cell carcinoma, although they differ considerably among

remainder were of squamous origin. There were no sarcomas.

Ewing (5), Boyd (6), and Illingworth

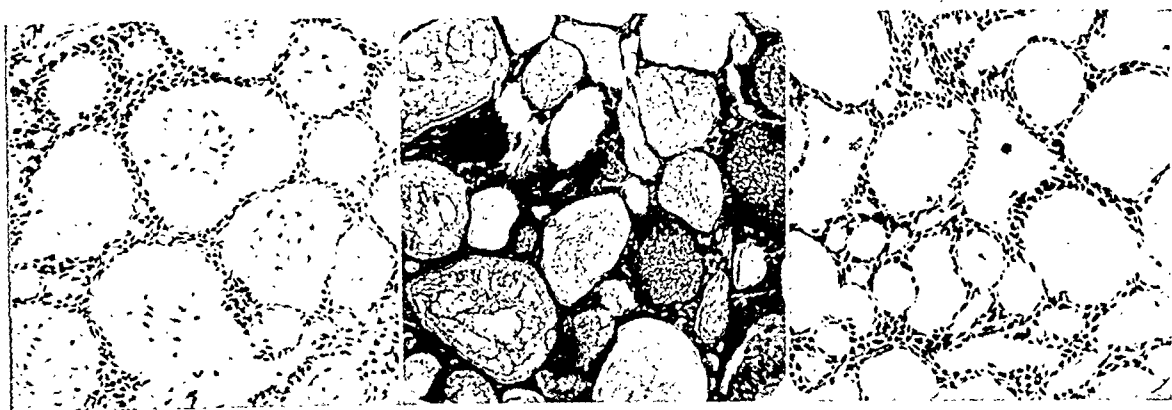


Fig. 10.

Fig. 11.

Fig. 12.

Figs. 10, 11, and 12. Various types of cyst in atypical basal-cell carcinomas. (H. and E. $\times 150$.)

themselves cytologically and probably also in origin.

Thirty-five of these tumors have been observed: 21 from the skin, 11 from the antrum and palate, two from the submaxillary, and one from the parotid gland. The salivary gland tumors may have a different genesis, but as they are histologically indistinguishable from the main group they have been included in it.

A typical basal-cell response, that is, resolution, occurred in only four cases. The remainder showed either only temporary cessation of growth or no response at all. A study of these cases has led to the conclusion that the presence of cysts, whether in reality representing an attempt at acinar formation or a degenerative process, indicates a high order of radioresistance, and in view of their slow growth suggests that surgery, when possible, is the treatment of choice.

Figures 10, 11, and 12 show some of the histologic variations of these tumors.

3. *Carcinoma of the Uterine Cervix.*—During the years 1932, 1933, and 1934 sections were available for study from 324 new cases of cancer of the cervix. Fifteen of these were adenocarcinomas and the

and Dick (7) state that full differentiation and keratinization are rare in cervical cancer. It is interesting to note that of the 324 growths examined 30 per cent showed areas of definite keratin formation.

All grades and combinations of grades of differentiation were represented, from the adult acanthoma to a growth strongly resembling basal-cell carcinoma.

A. There was a fairly well defined group of tumors of transitional-cell type presenting a characteristic histology. The cells were arranged in islands, with a well marked columnar-cell palisade layer at the periphery. Superficially, they resembled basal-cell carcinoma, but the cells were bigger and less hematoxyphil. Nuclear irregularities were infrequent (Figs. 13 and 14). As these tumors are cytologically most like bladder epithelium, and presumably arise from the cells between the spinal and basal layers of the epithelium, they are usually designated as transitional-cell carcinoma. This group, after eliminating any tumors showing areas of squamous differentiation, was segregated for comparison of its radiosensitivity with the more definitely squamous group.

The immediate response of the transi-

tional-cell group to irradiation was considerably better than that of the squamous group.¹ To ascertain whether this response

4. *Columnar-cell Carcinoma*.—Owing to technical difficulties, the treatment of carcinoma of the gastro-intestinal tract is

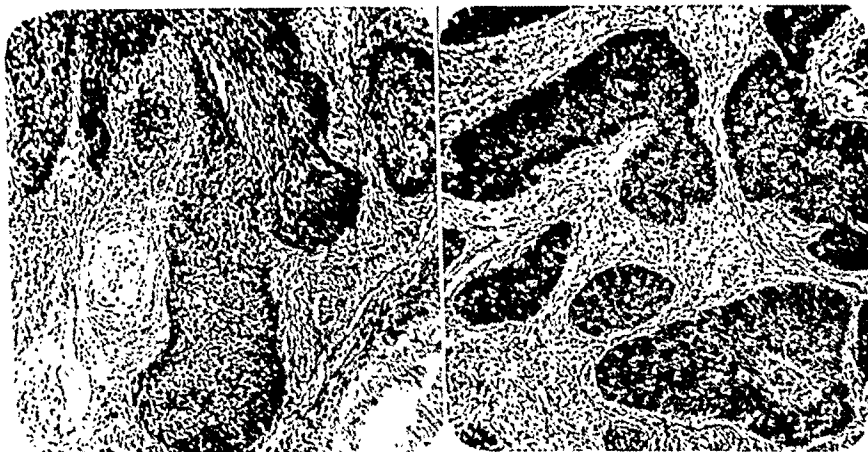


Fig. 13.

Fig. 14.

Figs. 13 and 14. Transitional-cell carcinomas of the uterine cervix, showing a resemblance to basal-cell growths. (H. and E. $\times 80$.)

was of prognostic importance, the four-year survival rates were worked out from the available material. Excluding cases treated by surgery, cases lost trace of, and deaths within one month of treatment, the total number was 240. Of these, 175 were squamous-, 50 transitional-, and 15 columnar-cell in origin.

The actual treatment figures do not fall within the scope of this paper, but although the average staging of the transitional-cell growths was 2.8, against 2.7 for the squamous, the four-year survival rate of the transitional type was 11 per cent better than that of the squamous group. This figure indicates that the transitional-cell group is more amenable to treatment, and, therefore, more radiosensitive than the squamous carcinomas.

B. The number of adenocarcinomas is small compared with the other groups. It is interesting to note that 15 cases showed an over 50 per cent four-year survival rate. Although no sweeping conclusion can be drawn from so few cases, the figures support the view at present gaining ground that adenocarcinoma of the cervix is not as radioresistant as was formerly supposed.

mainly surgical. The only classes of adenocarcinoma occurring in any numbers in this series were those of the rectum and body of the uterus.

The rectal carcinomas, about 30 in number, were nearly all grades B or C (Dukes, 8), either inoperable or else bad surgical risks. The results of irradiation, owing to the type of patient treated, were such as to leave few cases from which to judge of the radiosensitivity of the primary cancer. In two patients who died 9 and 12 weeks after treatment, however, no viable growth was found in the rectum at autopsy. In each of these cases the growth was a very anaplastic carcinoma of round-cell type, with little attempt at glandular formation. As is the rule with these anaplastic tumors, widespread metastases had occurred.

The growths of the body of the uterus present a much more hopeful picture. Of 27 of these treated during 1932, 1933, and 1934, from which histologic material was available, over 33 per cent were alive at the end of four years. Once again, the numbers are very small, but, obviously, this type of columnar-cell tumor cannot be classified as extremely resistant, as has been the tendency in the past.

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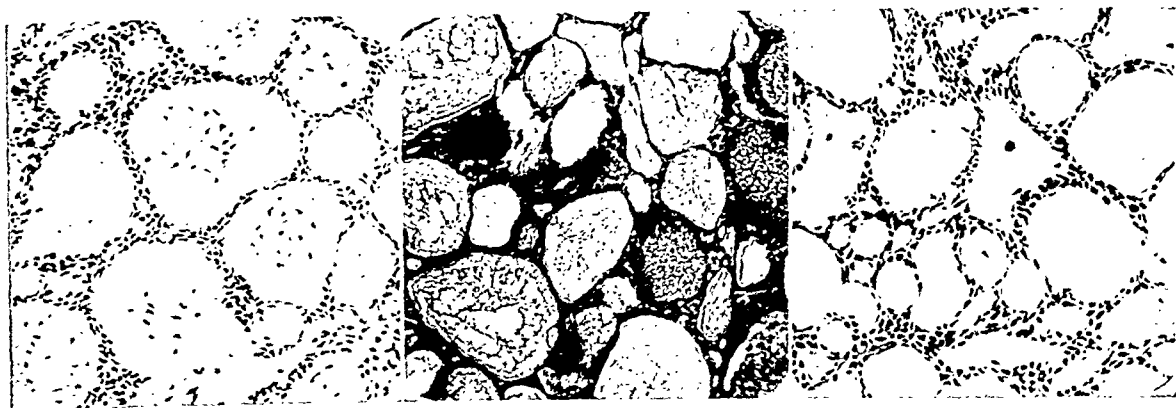


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sensitivity, and radiation therapy in no case effected a cure of the primary or inhibited the formation of metastases.

7. *Miscellaneous.*—There are certain histologic variations in skin tumors which have invariably been associated with a high degree of resistance.

A. A stellate appearance of the nuclei in an otherwise typical epithelioma was noted in the original biopsy in six instances (Fig. 15), and in each case surgical excision was necessary following irradiation.

The same appearance of the nuclei was noted more frequently in the basal-cell tumors, and these, while less refractory than the epitheliomas, were slower of response and more prone to recur (Fig. 16).

B. In two cases of typical epithelioma of the leg an unsatisfactory response to treatment was followed by the development of a small cell type of growth showing remarkably uniform cytology, few mitoses, and no prickly cells or keratin (Fig. 17). This appearance is unusual, and is quite unlike the normal post-radiation recurrence. Both of these small cell tumor recurrences showed no response to irradiation.

COMMENT

The foregoing observations on the variations within histologic classes of cancer are unfortunately entirely empirical, and the reason why these variations should alter sensitivity is obscure. With the increase in material, it is probable that more types of growth will be identified and their response to irradiation correlated with their histology.

Some of the tumors showing atypical histologic features showed a typical radiosensitivity, while on the other hand, in this

series of 5,500-odd cases there were many atypical responses by histologically typical tumors. It is obvious from these facts that it will be impossible to give a certain forecast of tumor sensitivity from the usual histologic preparations, as it would appear that the microscopic features of a growth bear a somewhat inconstant relationship to its sensitivity.

In spite of these drawbacks, however, it is well worth while when reporting upon biopsy material to indicate as nearly as possible the probabilities of radiosensitivity. As far as the main problem goes, it remains to seek some hitherto unidentified factor which varies consistently with the vagaries of tumor radiosensitivity.

SUMMARY

Some 5,500 sections from radiation-treated tumors have been reviewed.

An attempt has been made to correlate histologic variations with variations in radiosensitivity. The more clear-cut of these variants are illustrated and their probable response to irradiation indicated.

REFERENCES

- (1) REGAUD, NOGIER, and LACASSAGNE: Arch. d'electr. med. Bordeaux, 22, 321, 1912.
- (2) SCHMINCKE, L.: Ziegler's Beitrage z. path. Anat., 68, 161, 1921.
- (3) REGAUD, C.: Cited by Jovin, Ann. d. Mal. de l'Oreille et du Lar., 45, 729, 1926.
- (4) DAWSON, E. K., INNES, J. R. M., and HARVEY, W. F.: Edinburgh Med. Jour., 44, 645-652, October, 1937.
- (5) EWING, J.: Neoplastic Diseases, W. B. Saunders, Philadelphia, 1934.
- (6) BOYD, W.: Surgical Pathology. W. B. Saunders, Philadelphia, 1933.
- (7) ILLINGWORTH, C. F. W., and DICK, B. M.: Surgical Pathology. Churchill, London, 1935.
- (8) DUKES, C.: Proc. Roy. Soc. Med., 30, 371-376, February, 1937.
- (9) WILLIAMS, I. G., and MARTIN, L. C.: Lancet, 1, 135-138, Jan. 16, 1937.

UNUSUAL MANIFESTATIONS OF BONE TUBERCULOSIS¹

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THE Protean nature of bone tuberculosis, from the clinical, pathological, and roentgenological standpoints, can be gleaned from the modern literature, beginning with Koenig's work in 1884 to the present day.

A few years ago, 1920, Jüngling, under the term "osteitis tuberculosa multiplex cystica," called attention to a previously unknown form of this disease involving the short tubular bones of the hands and feet, occurring usually in children, or about the age of puberty. The lesion is, characteristically, a round or ovoid rarefied area, devoid of periosteal reaction or deposits, with practically no adjacent bone condensation and presenting a "cystic" appearance; the neighboring joints are not involved. The diseased bone strongly resembles that of lupus pernio. Several cases with disease of the short tubular bones, resembling spina ventosa, have been reported in patients with lupus pernio, with complete destruction of the terminal phalanges or marked alteration of the bone architecture.

Koenig described a symmetrical form of bone tuberculosis with bone resorption and cyst formation. Before Milgrim's review of 142 cases, these cyst-like lesions were thought to exist only in the bones of the hands and feet, and the coexistence of two uncommon sites of bone tuberculosis of any description in the same patient, such as the shaft of a long bone and the flat bones of the skull (Antwerp), were reported as rarities. It is possible, however, that neither the cystic character nor the diffuse involvement of various types of bones is as rare or as uncommon as case reports would seem to indicate.

Hodges and Phemister have fully de-

scribed the usual findings in bone and joint tuberculosis. According to them, shaft tuberculosis in children is usually primary, starting in the metaphyses and occasionally the epiphyses. The entire diaphysis may be involved, but the smaller bones of the hands and feet are attacked more often. Rarefaction of the shaft and cortices are the first roentgen signs, followed later by periosteal new bone, at times laminated, rarely forming sequestra. In metaphyseal tuberculosis in children, the lesion is first noted near the epiphyses as an oval or cone-shaped area of reduced density followed by periosteal and endosteal new bone. When the process extends into the epiphyses, cavities are produced. In adults, shaft tuberculosis is rather rare, attacking the smaller bones more frequently and producing spina ventosa. Roentgenographically it is characterized by a diffuse destruction of the shaft, accompanied by new bone formation along the periphery and in the medullary cavity; at times cavitation of the cortex and medulla, the destructive process always predominating.

Harrison states that trauma may be the deciding factor in the localization of the infection, and if the lesion is hematogenous more than one focus may result. He describes two main pathologic types: (1) The presence of soft granulation tissue without caseation, leading to bone absorption of the molecular type. There is no actual destruction of bone but an atrophy of bone with increased trabeculations, cellular infiltration, and granulation tissue filling the interstices. This condition is known as *caries*. (2) There is marked softening of bone, trabecular absorption and caseation, leading to suppuration. Very little osteosclerosis or periostitis develops. The lesion may be localized or may spread, forming necrosis with or without seques-

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tration. It may spread along the medullary cavity, epiphyseal cartilage, or epiphyseal cartilages into the joint. They often spread through the periosteum and form a subperiosteal abscess in the soft parts. Caries sicca usually occurs in the head of the humerus and is characterized by irregular erosion without the usual general decalcification, and sometimes is surrounded by a zone of increased density.

Joint Tuberculosis.—This is most common in children and the most common sites are the hips, knees, shoulders, and ankles. In adults the process starts as thickening of the synovium with granulation tissue, and extends into the joint. The synovial fluid becomes fibrosed and scanty; the articular cartilage is covered by a panus of granulations on its joint surface, and its under-surface is eroded by granulation from the subcortical region of the bone. The underlying bone is exposed by the erosion, and the cartilage separates. The bone itself shows a uniform atrophy, lime absorption, the peri-articular structures become involved, the ligaments soften and are destroyed, the muscles thicken and undergo gelatinous degeneration (while swelling). At times caseation, liquefaction, and necrosis may take place. Hodges and Phemister claim that the granulation tissue attacks the non-contacted portions of the cartilages and bone in the early stages. Roentgenographically, there is atrophy, destruction of the non-contacted cartilage and bone, loss of the shadow of the bony articular cortex, and preservation of the cartilage space. When the process, instead of starting in the synovia, occurs in the epiphysis, the lesion is wedge-shaped, the bone is killed and separates as a sequestrum, with preservation of its articular cortex. It appears on the film as a dense line, while the rest of the articular cortex is lost. When large sequestra form on each side of the joint, they are termed "Kissing's sequestra," and stand out as roughened dense, cone-shaped bones, with the articular margins preserved. Joint tuberculosis in children usually extends from the metaphysis, and resembles most often the adult

type, except when it occurs in the knee. Here the articular cartilage is thick, there is less destruction of the non-contacted bone and cartilage, and the subchondral granulations do not occur early.

Tuberculosis of Spine.—Harrison describes three main types of tuberculosis of the spine. In the first, the *central* type, the posterior spinal artery is the path of infection and the central portion of the body is first affected. This is most commonly seen in children under twelve years of age. In the second, the *intervertebral articular* type, the infection is conveyed by the epiphyseal arteries to the articular margins, with early destruction of the discs, producing narrowing of the latter, and later spreading to the contiguous vertebræ, with the formation of an abscess around them. The third is the *anterior* type. The infection here is brought by the intercostal arteries and is spread beneath the anterior common ligament, and remains localized in the latter or it may extend into the vertebral body. However, aside from these three types of infection, extension may occur by direct contact from the tuberculous abscess; at times, also, an abscess may spread along the spine, missing one or more vertebræ and attacking others. This is the so-called *skipped infection*. Abscess formation may occur before evidence of vertebral erosion. It is present in 80 per cent of the cases and is seen as a narrow band running along the anterior and lateral margins of the bodies. In advanced cases, the tuberculous abscess is somewhat bag-shaped, of moderate density on either side of the spine, broad at its lower end and narrow at its upper, smooth and straight where it is in contact with the spine, and curved on its lateral margins. In advanced cases the discs are narrowed, vertebral bodies destroyed, with no new bone formation. The anterior part of the body, anterior surface, and the surface in contact with the disc is involved, becomes wedge-shaped, and kyphosis develops. The wedge is due to preservation of the lamina and posterior parts of the body. In non-tuberculous osteitis of the vertebræ, angulation and lateral deformity are

absent, joints remain intact, bone production is evident, and the body escapes crushing.

Tuberculosis of the Skull.—Erdheim claims that it is most common in children, starts in the diploe, destroys bone, making a large opening in the internal plate and a smaller one in the external plate. Sequestra form and new bone is laid down on the border of the sequestra as a para-tuberculous osteosclerosis. Roentgenographically, there is loss of density in the central portion of the lesion, with an irregular rarefaction in the periphery due to loss of the inner table and preservation of the outer table. Surrounding these two zones there is an area of bone sclerosis. In syphilis, there is greater destruction of the outer table, with more sequestration and new bone formation.

The cases herein reported, 21 in number, are of interest because of the varied age incidence, the widespread, extremely varied and bizarre destructive lesions of bone, and the lack of anything characteristic of these changes that would suggest the nature of the disease process. Many of these lesions closely resemble metastatic malignancy and often conform to the extensive dissemination of the latter, for in the destructive type of bone tuberculosis, periostitis is seldom encountered; neither is there any surrounding bone condensation. On the other hand, periostitis is considered a distinct diagnostic feature in bone syphilis and its association with cortical destruction serves at times to differentiate it from forms of osteomyelitis in which it is either absent or much less pronounced; the latter usually presents a varying degree of surrounding bone condensation. Individual bone tuberculous lesions, however, may be confused with primary bone tumors, fungus infections, or, if associated with a cold abscess adjacent to the shaft of a long bone, with parosteal fibrosarcoma. Again, in the absence of a cold abscess, tuberculous lesions of the spine might closely resemble giant-cell tumor, erosion of the body by aneurysm, or other transmitted pulsations; also non-tuberculous infections. One of the most

confusing situations is the evaluation of atypical bone-destructive tuberculous lesions of widespread distribution, in the case with proven malignancy. Here the history of the case most often results in the diagnosis of metastatic malignancy based primarily on the percentage of possibilities.

CASE REPORTS

Case 1. E. B., colored, male, aged 22 years. For the past year he has had dull pains in his back, with sudden paralysis of his extremities about a month ago. Partial loss of power of lower extremities and impairment of pain sensation from ninth dorsal downward. Laboratory findings: Red blood cells, 2,670,000; white blood cells, 6,300; 70 per cent hemoglobin; 55 per cent polymorphonuclears; 40 per cent lymphocytes; 5 per cent transitionals. X-ray examination: Fluid in right chest; destruction of sixth left rib, posteriorly; fourth, eighth, and tenth also, on left side. All the destroyed ribs showed overlying soft-tissue tumors. X-ray diagnosis: Pulmonary tuberculosis, left upper lobe; tuberculous osteomyelitis of ribs, ninth and tenth dorsal vertebræ. Final diagnosis: Transverse myelitis. Tuberculous osteitis of ribs, ninth and tenth dorsal vertebræ. Comment: Multiple lesions in ribs with overlying cold abscess and extension to vertebræ and spinal cord.

Case 2. F. J., colored, male, aged 17 years. A two-months' history of pain and soreness in the back, with swelling in the right loin. The swelling later developed into an abscess which was opened and drained several times. Laboratory findings: Red blood cells, 5,400,000; 90 per cent hemoglobin; white blood cells, 10,400; polymorphonuclears 54 per cent; lymphocytes 22 per cent; transitionals 18 per cent. Kahn test negative. Tubercle bacilli obtained from pus cultures. X-ray examination: Lungs, negative. Destruction of anterior portion of fourth dorsal vertebra, with no disc involvement or cold abscess. Abscess in lumbar region, with no underlying bone involvement. Com-

ment: The anterior portion of the fourth dorsal was destroyed, with no disc involvement or cold abscess formation. However, there was a lumbar abscess present, with no underlying bone involvement, the proc-

2 per cent lymphocytes; 14 per cent transitionals. X-ray examination: Soft-tissue tumors with destruction of underlying ribs of the first right posterior, right and left second ribs anterior, manubrium of ster-

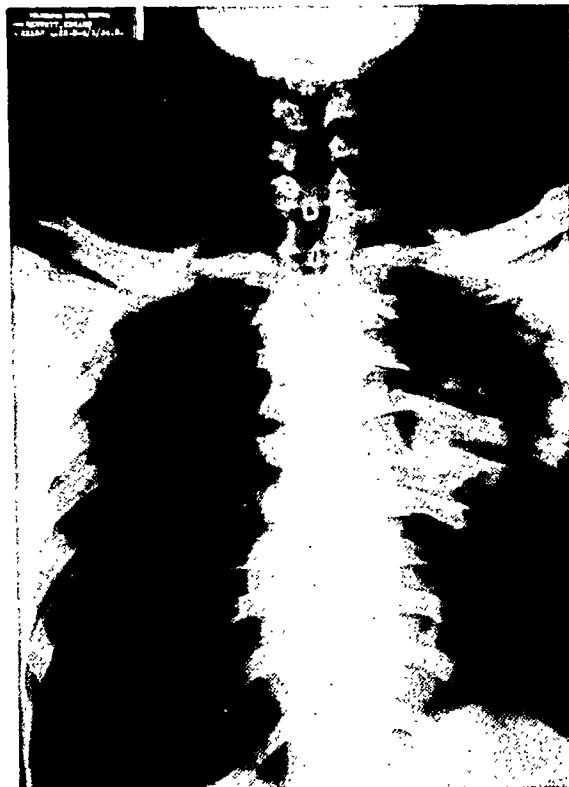


Fig. 1.

Fig. 1. Case 1. Multiple tuberculomas, with destruction of underlying posterior ribs and lateral portions of the vertebrae.

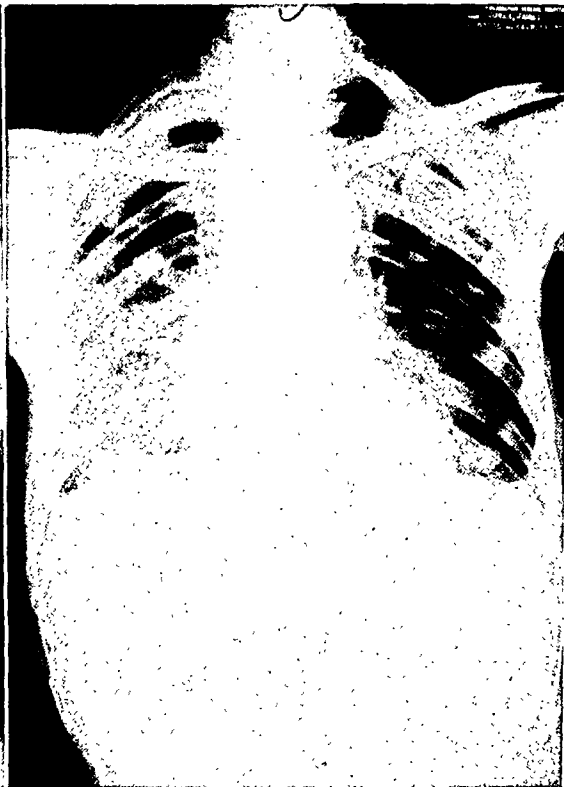


Fig. 2.

Fig. 2. Case 3. Many soft-tissue tumors of the thoracic cage, with osteolytic destruction of the underlying ribs, sternum, and vertebrae not unlike metastatic malignancy.

ess evidently extending from the lesion in the fourth dorsal.

Case 3. J. J., colored, male, aged 44 years. Six-month history of soreness and pain from the hips to the neck, with symptoms of cough, expectoration, chest pain, and many soft-tissue, fluctuant, tender masses over the anterior and posterior portions of chest. The masses were tender, situated over the anterior ribs, sternum, and lower portion of posterior ribs. Laboratory findings: Red blood cells, 3,670,000; hemoglobin 70 per cent; white blood cells, 8,000; 84 per cent polymorphonuclears;

num, eighth rib posterior, with fluid in both bases. X-ray diagnosis: Metastatic malignancy. Autopsy diagnosis: Tuberculous osteitis of bones of the thorax, with erosion of sternum, ribs, and eighth thoracic vertebra, and localized abscesses of the thoracic cage. Metastatic abscesses of liver and spleen, and terminal miliary dissemination. Comment: Multiple soft-tissue tumors of thoracic cage, with underlying bone destruction simulating metastatic malignancy.

Case 4. J. H., colored, male, 17 years of age. Onset eight years ago with axillary

adenitis and abscess formation, right side, which failed to heal and formed a fistula. One year later, the right third, fourth, and fifth ribs showed an osteomyelitic process and extension to the pleuræ one year later.

had noticed the appearance of sores on various parts of the body, which healed very slowly. On admission, many palpable nodes, scars, and indolent ulcers were found on both forearms, the hands, the

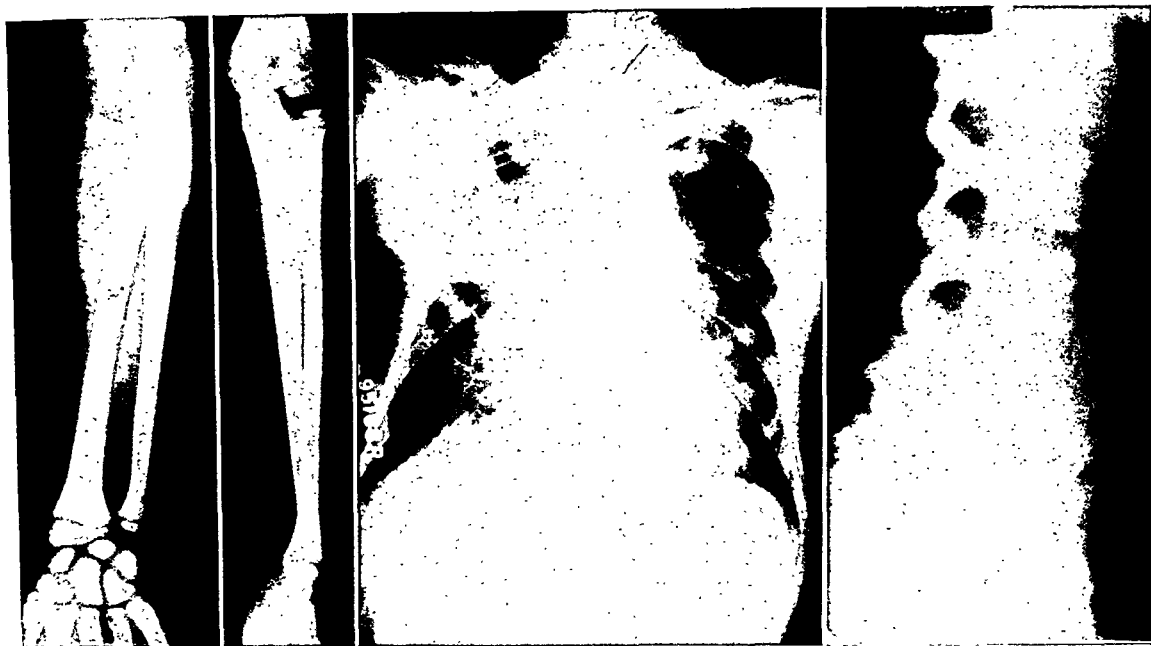


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 3. Case 5. Cystic destruction of shaft of ulna with surrounding bone sclerosis but no periostitis.

Fig. 4. Case 6. Osteolytic destruction of right second anterior rib. Tumor in right breast, with extensive hilar and peri-hilar infiltration, and pleural thickening in right lung.

Fig. 5. Case 7. Marked osteolytic, moth-eaten, diffuse destruction of the lumbar vertebræ and neural arches, with no involvement of the discs or joint spaces.

Three years after onset, tuberculosis of the right hand, wrist, and shoulder joints developed, and the right arm was amputated. Laboratory findings: Hemoglobin 65 per cent; white blood cells, 7,600. Wassermann test, negative; sugar and albumen, negative. Six years after onset the liver, spleen, and kidneys were found to be enlarged due to amyloidosis. Final diagnosis: Tuberculosis of the right third, fourth, and fifth ribs; right pleura, amyloidosis, with subsequent extension to right shoulder and wrist. Comment: Multiple destructive lesions in ribs, wrist, shoulder, and pleuræ, with primary focus in the lymphatic glands.

Case 5. H. B., colored, male, aged nine years. Since the age of three, his mother

back, the right fifth finger, and the left knee. An ulcerative process on the ulnar side of the left forearm failed to respond to ultra-violet, x-ray, or general constitutional therapy. Wassermann test was negative. X-ray examination showed the lungs to be normal. Dactylitis, right first metacarpal; erosion of cortex and posterior border of upper third left ulna, with cavity formation and moderate cortical sclerosis. A diagnosis of tuberculosis of the shaft of the ulna and right first metacarpal was made. Comment: Although there was no periostitis, yet the cystic destruction and cortical sclerosis, together with the dactylitis, resembled a syphilitic process.

Case 6. A. L., white, male, aged 55

years. Pain and swelling in the left knee for two years, with a draining sinus below the tibial spine. A year later a firm, rubbery, solid lump developed in the right breast. X-ray examination: Lungs, nor-

developed a lump in the right inguinal region which enlarged, opened, and drained. Three weeks later he noted a bilateral swelling and, later, an abscess formation in the lower lumbar region. Both were



Fig. 6.

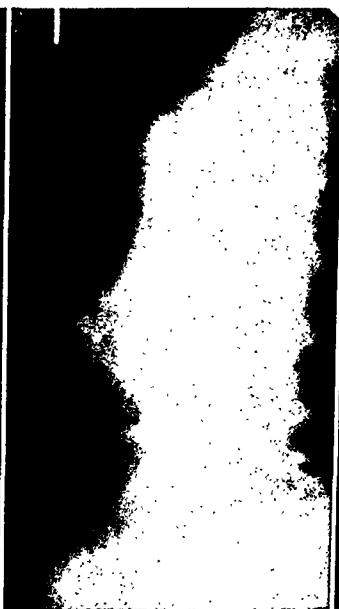


Fig. 7.



Fig. 8.

Fig. 6. Case 8. Almost complete destruction of tenth dorsal vertebra, with destruction of the posterior portion of the bodies and pedicles of ninth and eleventh, with good preservation of the discs. Patient had a primary lesion in the breast which was considered malignant.

Fig. 7. Case 9. Extensive multiple destructive lesions of vertebrae, with pathologic fractures and considerable destruction of the lamina and pedicles mistaken clinically for metastatic malignancy.

Fig. 8. Case 10. Marked anterior and lateral destruction of bodies of the lumbar vertebrae, with extensive calcification of the anterior and lateral ligaments, and very little involvement of the discs.

mal. A radiolucent area in the left knee, in the upper and anterior portion of the tibia, surrounded by a bony condensation, and periostitis. Also a soft-tumor mass overlying the right breast, with destruction of the first and second anterior ribs. Wassermann test, negative. Biopsy from breast tumor showed tubercle bacilli. Diagnosis: Tuberculosis of left tibia, tuberculous mastitis, and tuberculous involvement of first and second ribs. Comment: For a long time the breast tumor was considered malignant. Treated with x-ray, with no response. The lesion in the tibia was considered a low-grade abscess.

Case 7. O. J., male, colored, 28 years of age. About a month before admission he

opened and drained for some time. Laboratory findings: Kahn test, negative. Culture from pus, negative for tuberculosis. Red blood cells, 3,420,000; white blood cells, 14,500; 85 per cent polymorphonuclears; 12 per cent lymphocytes; 3 per cent transitionals. X-ray examination: Moth-eaten osteitis of third, fourth, and fifth lumbar vertebrae, with good preservation of the discs. Autopsy: Tuberculous osteomyelitis of third, fourth, and fifth lumbar vertebrae, and terminal miliary tuberculosis. Comment: The preservation of the discs, with the moth-eaten picture of the spine, led to a clinical diagnosis of metastatic malignancy.

Case 8. G. B., colored, female, aged 50

years. One year ago the patient developed a large mass in the right breast, which ulcerated about six months later. About that time she also developed shortness of breath, pain in the left shoulder and back,

eleventh, with good preservation of the discs, and the lump in the breast led to a diagnosis of metastatic malignancy.

Case 9. J. B., colored, male, aged 52 years. Two years previously, he developed

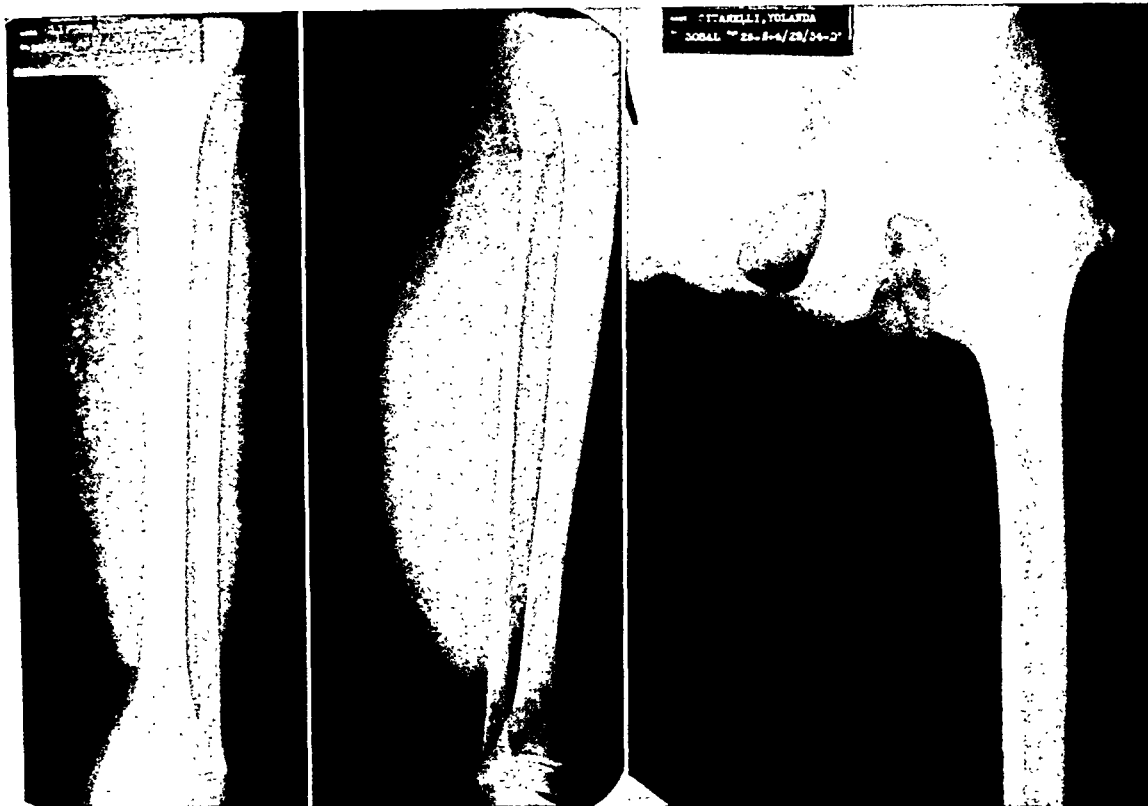


Fig. 9.

Fig. 9. Case 12. Well localized, soft-tissue tumor of right leg, with only a localized periostitis in the fibula suggesting a fibrosarcoma.

Fig. 10.

Fig. 10. Case 16. Atypical, rarefying, destructive lesion on greater tuberosity of left femur, with later involvement of the hips and vertebrae.

and weakness of both lower extremities. The condition was considered malignant, and received roentgen therapy. Laboratory findings: Kahn test, negative. X-ray examination: Lungs, normal. Almost complete destruction of tenth dorsal vertebra; posterior portions of the bodies of the ninth and eleventh, together with transverse processes and pedicles. Autopsy: Tuberculosis of right breast, with extension to the lymph nodes and vertebrae. Comment: The destruction of the tenth dorsal and atypical destruction of the ninth and

pain in the lower back, lower right chest, and both shoulder girdles. Two weeks before admission he developed weakness in his trunk and lower limbs. Laboratory findings: Wassermann test, negative; urine and blood chemistry, normal; red blood cells, 3,900,000; white blood cells, 11,600; polymorphonuclears 59 per cent; lymphocytes 16 per cent; transitionals 3 per cent. X-ray examination: lungs, normal; destruction of fourth, sixth, and eighth ribs, right side, with pathologic fractures. Moth-eaten destruction of second to fifth

lumbar vertebræ, and the pedicles and lamina of second and third lumbar. The fifth dorsal was also involved. Diagnosis: Metastatic malignancy. Autopsy: Tuberculous osteomyelitis of ribs and vertebræ and myelomalacia of the cord. Comment: Multiple destructive lesions of the ribs and vertebræ, with pathologic fractures and no cold abscesses, diagnosed clinically as metastatic malignancy.

Case 10. R. J., colored, male, 22 years of age. Four years before admission he developed pain in the back and was put in a body cast for one year. Three years later three small lumps appeared over the sternum, the medial aspect of the left thigh, and behind the right great trochanter. These were all cold abscesses which opened and drained spontaneously. Culture negative for tuberculosis. X-ray examination showed destruction of lateral and anterior portions of the bodies of the last two dorsal and lower lumbar vertebræ. All the transverse processes were similarly involved. The discs were normal, the lungs were clear, but there was extensive new bone formation along the lateral and anterior ligaments. Diagnosis: Tuberculous osteomyelitis of the lower dorsal and lumbar vertebræ. The unusual findings here were the marked anterior and lateral destruction of the bodies, with extensive new bone formation.

Case 11. D. A., male, colored, 26 years of age. One year prior to admission he noticed superficial masses appearing over sternum, right axilla, and over the ninth left rib posteriorly. They were all incised and drained. Later new masses appeared in the right lower chest and the right forearm. Laboratory findings: Wassermann test, positive; red blood cells, 2,600,000; white blood cells, 5,700. X-ray examination: Extensive rarefaction of third, eighth, and eleventh ribs, both sides; tuberculosis of the right upper lobe, and left pleural effusion. Autopsy: Tuberculous osteomyelitis of ribs, lower thoracic and sacral vertebræ; tuberculosis of lungs, spleen, and lymph nodes. Comment: Although only the rib involvement was noticed on x-ray

examination, yet at autopsy there was seen diffuse osteitis of the lower dorsal and sacral vertebræ.

Case 12. E. C., nine years old, colored, female. One year ago there developed a swelling of the left leg, with tenderness in the left elbow and right ankle. The abscess in the left leg opened and drained, and the culture was positive for tuberculosis. Ten months later there developed meningitis, of which she died a month later. X-ray examination: Lungs, clear. Periosteum in lower one-third of fibula elevated and thickened, and there was a localized soft-tissue tumor in lower portion of the fibula. Probable diagnosis before biopsy was "syphilis sarcoma." Comment: A soft-tissue tumor with a localized periostitis in the fibula, as in this case, would suggest a fibrosarcoma, syphilis, or osteogenic sarcoma, rather than tuberculosis.

Case 13. J. W., colored, male, 18 years of age. Four months before admission he noticed pain in the right hip and inability to bend backward. One month later pain radiated down both legs and knees, and he experienced great difficulty in walking. Laboratory findings: Wassermann, sputum, and blood counts, negative. X-ray examination: Lungs, normal. First examination showed only slight fuzziness of the trabeculæ: later a moth-eaten appearance with irregularity of upper articulating surfaces; some crushing of posterior half of the body with disc intact and no cold abscess. Autopsy: Tuberculosis of fourth lumbar vertebra with extension to cord. Comment: The interesting observations here are the preservation of the discs, posterior destruction of the body, no cold abscess, and only one body involved.

Case 14. L. T., colored, female, 22 years of age. Two months before admission she noticed a tender, swollen area on the right side of the neck, the pain radiating down the right arm and back. On examination, the posterior pharynx bulged anteriorly and to the right; the neck was stiff and swollen. Laboratory findings: Kahn and sputum tests, negative. Tem-

perature 100–104°: red blood cells, 3,800,000; white blood cells, 12,900. The retropharyngeal space and, later, the right lateral neck were opened, and drained for ten days. Culture from the pus and biopsy

diffuse osteitis was not suggestive of tuberculosis.

Case 15. A. M., male, white, 53 years of age. One and a half years before, following an injury, a lancing and, at



Fig. 11.



Fig. 12.

Fig. 11. Case 17. Large mediastinal cold abscess communicating externally with the formation of a fluid level, resembling a hydropneumopericardium.

Fig. 12. Case 20. Cystic destruction of anterior portions of the bodies of the vertebræ, with no involvement of the joint spaces, resembling giant-cell tumors or osteitis fibrosa cystica.

from the wounds, negative for tuberculosis. X-ray examination: Lungs, normal. Upper retropharyngeal space widened. Diffuse and mottled rarefaction of first and second cervicals. Discs, normal. Clinical diagnosis: Osteomyelitis and retropharyngeal abscess. Autopsy: Tuberculosis of first and second cervical vertebræ. Retropharyngeal cold abscess. Caseous nodule in lower right chest, and early tuberculous involvement of upper ribs and sternum. Comment: The laboratory findings here were not very helpful and the

times, boring pain developed in the lower back, aggravated by sneezing, coughing, and bending. Two months later he noticed difficulty in walking, and weakness in lifting both legs. Laboratory findings: Red blood cells, 4,280,000; white blood cells, 8,100; spinal fluid, clear. Protein, 162. X-ray examination: Lungs, normal. Ninth dorsal vertebra tilted upon the tenth: destruction of lamina and posterior spine of the tenth: remaining vertebræ, normal. Clinical diagnosis: Transverse myelitis due to cord tumor. Au-

topsy: Transverse myelitis. Tuberculosis of ninth and tenth dorsals. Comment: The destruction of the pedicles and lamina of the tenth dorsal, with little destruction of the body and disc, led to a diagnosis of cord tumor.

Case 16. Y. C., white, female, 26 years of age. Six years before, she developed an abscess in the right scapular region, together with cough, expectoration, and night sweats. Two years before, a cold abscess appeared in the left hip, and drained for one year. One year ago the hip was opened and the greater trochanter removed surgically. Laboratory findings: Red blood cells, 2,950,000; 87 per cent polymorphonuclears; 12 per cent lymphocytes; 1 per cent transitionals. Biopsy of trochanter, negative for tuberculosis. X-ray examination: Bilateral fibro-ulcerative tuberculosis. Tuberculosis of left trochanter, and, in later examination, tuberculosis of both hips, bodies and transverse processes of lower dorsal vertebræ, and lower ribs. Comment: The interesting findings here were the early tuberculous lesions in the great trochanter, then spreading to both hips, dorsal vertebræ, and ribs, with no involvement of the discs or cold abscess formation.

Case 17. A. R., female, colored, 29 years of age. After a fall 15 months before, there developed sharp, shooting pains in the dorsal region. She was treated for fracture, with hyperextension. X-ray examination showed a large, globular mass superimposed on the heart, with the formation of a large fluid level on subsequent examination. Compression of fifth, sixth, and seventh dorsal vertebræ. Lungs, normal. Autopsy: Tuberculosis of fifth, sixth, and seventh dorsal vertebræ. Large cold abscess in posterior mediastinum which ruptured externally. Heart, normal. Comment: Large cold abscess covered the heart shadow, resembling a pericarditis with effusion, particularly after the formation of the fluid level.

Case 18. A. P., male, colored, 25 years of age. Fourteen months before, there developed cough, hemoptysis, night sweats,

and chest pain. A year later he noticed bilateral exophthalmos and marked edema in the peri-orbital tissues. Laboratory findings: Wassermann test, negative. X-ray examination: Bilateral fibro-ulcerative tuberculosis. Pituitary, normal. Marked sclerosis of frontal, sphenoidal, and ethmoidal bones, with similar involvement of the floors of anterior, middle, and posterior fossæ. Only a few radiolucent areas were noted in the base of the skull. Comment: The tuberculous condensing osteitis of the skull, with very small destructive areas, simulated more a syphilitic osteitis.

Case 19. C. D., male, colored, 16 years of age. The onset was two years before, with pain and swelling in both knees, shoulders, left elbow, and right wrist. The abscesses opened and drained for some time and the patient later developed difficulty in walking. X-ray examination: Fibro-ulcerative tuberculosis. Tuberculosis of lower dorsal and lumbar vertebræ, right shoulder, and wrist, and early synovitis of both knees. Wassermann test, negative. Autopsy: Fibro-ulcerative tuberculosis. Tuberculosis of right shoulder, right and left elbows, wrists, knees, stomach, and ileum. Comment: This case is of interest because of the extensive bone and joint involvement, including the stomach and small intestines.

Case 20. A. M., male, colored, 17 years of age. Cough, expectoration, and chest pains developed four years ago, with difficulty in breathing. Three years later low back pains originated, which had grown worse in the last three months. On examination, a well-nourished male with severe back pain, with limited expansion and motion on left side. X-ray examination: Lungs, normal. Eleventh and twelfth dorsals, first and second lumbar vertebræ, showed cystic destruction of the anterior portions of the bodies: discs intact. Comment: The anteroposterior view of the spine was negative. Only the lateral view showed the cyst formation and intact discs, resembling somewhat osteitis fibrosa cystica or giant-cell tumor.

Case 21. R. C., colored, female, 21

years of age. About four months ago the patient noticed a sore on the left arm, which was opened and has drained ever since. Shortly after, other lumps began to appear in the left breast, left axilla, neck,

CONCLUSIONS

Twenty-one cases of atypical bone tuberculosis are reported. Of these, 15, or 72 per cent, were males; six, or 28 per cent, females; 18, or 86 per cent, colored; three, or 13 per



Fig. 13. Case 21. Cystic tuberculosis of lower end of radius, not unlike a giant-cell tumor.

back, and legs. All have opened and drained. No masses in abdomen. Heart and lungs were negative. Reflexes, normal. Laboratory findings: Red blood cells, 3,640,000; white blood cells, 15,400. Biopsy of lymph nodes: Tuberculous lymphadenitis. X-ray examination showed cystic tuberculosis of the lower end of the right radius, first and second lumbar vertebrae. Comment: Another case of cystic tuberculosis of the radius and vertebrae, offering a differential diagnosis with other cystic conditions.

cent, white. The ages ranged from nine to 55, with an average of 27 years and six months. The average duration of the symptoms was two years. Only two cases, or 9.5 per cent, had associated pulmonary tuberculosis. One had a positive Wassermann, in spite of the fact that most of the patients were colored. Confirmation of the diagnosis was made in ten cases, or 48 per cent, by autopsy; in five, or 24 per cent, by biopsy, and one, or 4.25 per cent, by aspiration. The lesions varied: some showed widespread destruction of bone

with good preservation of the discs; others, numerous tuberculomas in the soft tissues with infiltration of the underlying bones. Other findings were cyst formations, condensing osteitis, destruction of the neural arches with preservation of the bodies, cold abscess with little bone involvement.

SUMMARY

The usual manifestations of osseous tuberculosis have been described, together with a review of some of the atypical forms of tuberculosis. Of the cases reported, 86 per cent were of the colored race and only 9.5 per cent had pulmonary tuberculosis. The mode of infection was mostly hematogenous or by the lymphatics. The lesions were very widespread and resembled metastatic malignancy, cyst formation, and primary bone tumors.

REFERENCES

- (1) HODGES, PAUL C., PHEMISTER, D. B., and BRUNSWIG, ALEXANDER: *The Roentgen-ray Diagnosis of Diseases of the Bones and Joints*. Thomas Nelson and Sons, 1938.
- (2) HARRISON, B. J. M.: *A Text-book of Roentgenology: The Roentgen Ray in Diagnosis and Treatment*. William Wood and Co., Baltimore, 1936.
- (3) WAGONER, G., and PENDERGRASS, E. P.: *Intrinsic Circulation of Vertebral Body, with Roentgenologic Considerations*. *Am. Jour. Roentgenol. and Rad. Ther.*, 27, 818-826, June, 1932.
- (4) PHEMISTER, D. B.: *Changes in Articular Surfaces in Tuberculosis and in Pyogenic Infections of Joints*. *Am. Jour. Roentgenol. and Rad. Ther.*, 12, 1-14, July, 1924.
- (5) Idem: *Effect of Pressure on Articular Surfaces in Pyogenic and Tuberculous Arthritides and its Bearing on Treatment*. *Ann. Surg.*, 80, 481-500, October, 1924.
- (6) Idem: *Changes in Articular Surfaces in Tuberculous Arthritis*. *Jour. Bone and Joint Surg.*, 7, 835, October, 1925.
- (7) JÜNGLING, O.: *Ostitis Tuberculosa Multiplex Cystica*. *Fortschr. a. d. Geb. der Röntgenstrahlen*, 27, 375, 1919-21.
- (8) SNYDER, C. H.: *The Association of Pulmonary and Other Tuberculous Lesions in Cases of Proven Bone and Joint Tuberculosis*. *Jour. Bone and Joint Surg.*, 15, 924-930, October, 1933.
- (9) JESSEN, H.: *The Cystic Form of Bone Tuberculosis*. *Beiträge zur Klinik der Tuberkulose*, 60, 96, 1925.
- (10) DICKSON, FRANK D.: *Tuberculosis of Bones and Joints*. *Jour. Missouri Med. Assn.*, 31, 63-67, February, 1934.
- (11) BENNETT, GEORGE E., and JONES, H. ALVAN: *Tuberculosis of a Diaphysis: Report of a Case*. *Arch. Surg.*, 30, 563-572, April, 1935.
- (12) VONBOGNAR, JOHAN: *Tuberculous Bone Cysts*. *Acta chir. Scandinav.*, 67, 135-142, 1930.
- (13) KOENIG, F.: *Die Tuberkulose der Knochen und Gelenke*. A. Hirschwald, Berlin, 1884.
- (14) ERDHEIM, J.: *Tuberculosis of Bone. Über Tuberkulose des Knochens im allgemeinen und die des Schädeldaches im besonderen*. *Virchow's Arch. f. path. Anat.*, 283, 354-412, 1932.

time from four months to ten years, but in most of the cases this condition had been present more than a year. Hypermenstrua-

menstrually for a number of years, which did not yield to any local treatment or endocrine therapy. This patient was cured by x-ray treatment.

TABLE IV.—HYPERMENSTRUATION IN SINGLE WOMEN

Age Group	No.	Good Results	
		No.	Percentage
20 to 30 years	2	2	100
31 to 40 years	1	1	100
Total	3	3	100

The cases were further subdivided into one group consisting of married women, and another group consisting of single women. Taking first the single women, the results obtained in those with deficient menstruation are shown in Table III. The results in single women with hypermenstruation are analyzed in Table IV. In married women the results of x-ray treatment for deficient menstruation without sterility are noted in Table V. Table VI analyzes the results in cases of deficient menstruation with sterility in married women. Hypermenstruation without sterility is analyzed in Table VII, and hypermenstruation with sterility is shown in Table VIII. The results of x-ray treatment in women whose menstrual periods were regular but who were sterile is shown in Table IX. There were four cases treated for menopausal symptoms. These were done early in our experience, and the results did not seem to justify continuance of this treatment; however, we are showing the results in Table X.

tion includes metrorrhagia and menorrhagia, and was of six weeks' to ten years' duration. There were a few cases in which there was both oligomenorrhea and metrorrhagia or menorrhagia. These were classified as to the predominant change. Particularly enough, among the 108 cases there was only a small number who complained of dysmenorrhea, and in passing we may say that this symptom was rarely improved by the x-ray treatment.

The 108 patients were analyzed as to age group in the different classifications, as shown in Table II. As you will note, there is one patient who was treated only because she developed an ulcerated mouth pre-

As would be expected, the results were better in the age group between 20 and 30

TABLE V.—MARRIED WOMEN: DEFICIENT MENSTRUATION WITHOUT STERILITY

Age Group	No.	Good Result		Partial Result		Negative Result	
		No.	Percentage	No.	Percentage	No.	Percentage
20 to 30 years	8	3	37½	1	12½	4	50
31 to 40 years	7	2	28	1	16	4	56
Total	15	5	28	2	14½	8	57½

TABLE VI.—MARRIED WOMEN: DEFICIENT MENSTRUATION WITH STERILITY

Age Group	No.	Menstruation Normal Pregnancy		Menstruation Normal—No Pregnancy		Negative	
		No.	Percentage	No.	Percentage	No.	Percentage
Up to 20 years	1			1	100		
21 to 30 years	26	15	57½	6	23	5	19½
31 to 40 years	13	3	23	5	38½	5	38½
Total	40	18	45	12	30	10	25

than in the older groups, probably because in the latter group the uterine mucosa was so altered that the normal response to the restored endocrine factor could not take place.

Roughly speaking, the 108 cases analyzed were referred to us for treatment by two classes of physicians. One group of cases was referred to us for treatment by very competent gynecologists who thoroughly understood and had investigated the endocrine factor in the production of symptoms. The other group consisted of cases that did not receive a thorough endocrine and gynecological study. Some of these cases were referred by general practitioners who had heard or been informed that this class of patients was amenable to x-ray treatment. It then became of interest to find out whether or not the results obtained in those who were thoroughly studied were better than in those who were referred without complete study. This comparison is shown in Table XI.

You will note that the percentage of good results in married women with deficient menstruation and sterility is practically the same in the two classes of patients. There is a slightly greater percentage of good results in the thoroughly investigated cases of deficient menstruation without sterility, and a very much greater percentage of good results in single women with deficient menstruation.

It stands to reason that in cases in which the endocrine disturbance is the etiologic factor, the best results will be obtained. Naturally, in cases in which we find both menstrual dysfunction and sterility the endocrine disturbance is probably greater and, therefore, the results of x-ray treatment are good, irrespective of whether or not the patient has had a thorough study.

But in instances in which the endocrine disturbance is probably not as great, as, for example, in those cases without sterility, then a thorough weeding-out by competent gynecologists of those patients who

TABLE VII.—MARRIED WOMEN: HYPERMENSTRUATION WITHOUT STERILITY

Age Group	No.	Good Result		Partial Result		Negative Result	
		No.	Percentage	No.	Percentage	No.	Percentage
20 to 30 years	2	2	100				
31 to 40 years	5	1	20	1	20	3	60
Total	7	3	43	1	14	3	43

TABLE VIII.—MARRIED WOMEN: HYPERMENSTRUATION WITH STERILITY

Age Group	No.	Menstruation Normal Pregnancy		Menstruation Normal No Pregnancy		Partial Result		Negative Result	
		No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
20 to 30 years	6			1	17	1	17	4	66
31 to 40 years	1	1	100						
Total	7	1	14	1	14	1	14	4	58

TABLE IX.—MARRIED WOMEN: REGULAR PERIODS WITH STERILITY

Age Group	No.	Good Result		Negative Result	
		No.	Percentage	No.	Percentage
20 to 30 years	9	3	33½	6	66½
31 to 40 years	3	2	66½	1	33½
Total	12	5	41½	7	58½

have some other etiologic factors associated, increases the percentage of good results and that is borne out by our statistics.

We are thoroughly convinced that all of these patients before being referred for x-ray therapy should have a very thorough examination, particularly of the endocrine factor, and that these patients should be referred by the general practitioner to a competent gynecologist for pelvic and endocrine studies before x-ray therapy is instituted.

Table XII summarizes the percentage of

positive and negative results obtained in the various classifications. You will note that the best results were obtained in patients of deficient menstruation with sterility, but that in all our patients, between 40 and 66 per cent showed definite improvement. These, as far as we could ascertain, were permanent. There were some cases in which there was a temporary establishment of normal menstruation for a short time. Many of these received a second series of three treatments, but in very few cases did this second series ac-

TABLE X.—MARRIED WOMEN: MENOPAUSE

Age Group	No.	Good Result		Negative Result	
		No.	Percentage	No.	Percentage
30 to 40 years	1	1	100		
41 to 50 years	3	1	33 $\frac{1}{2}$	2	66 $\frac{1}{2}$
Total	4	2	50	2	50

TABLE XI

Thoroughly Investigated Cases				All Other Cases			
Married Women—Deficient Menstruation with Sterility							
No. Cases	Good Result	Partial Result	Negative	No. Cases	Good Result	Partial Result	Negative
15	46½ per cent	20 per cent	33½ per cent	25	48 per cent	32 per cent	20 per cent
Married Women—Deficient Menstruation without Sterility							
No. Cases	Good Result	Partial Result	Negative	No. Cases	Good Result	Partial Result	Negative
5	40 per cent	20 per cent	40 per cent	10	30 per cent	10 per cent	60 per cent
Single Women—Deficient Menstruation							
No. Cases	Good Result	Partial Result	Negative	No. Cases	Good Result	Partial Result	Negative
5	60 per cent	...	40 per cent	14	29 per cent	14 per cent	57 per cent

TABLE XII.—RÉSUMÉ

Classification	Good Result	Negative Result
Deficient menstruation with sterility	66 $\frac{1}{2}$ per cent ¹	33 $\frac{1}{2}$ per cent
Deficient menstruation without sterility	47 $\frac{1}{2}$ per cent	52 $\frac{1}{2}$ per cent
Hypermenstruation with sterility	42 $\frac{1}{2}$ per cent	57 $\frac{1}{2}$ per cent
Regular periods with sterility	41 $\frac{1}{2}$ per cent	58 $\frac{1}{2}$ per cent
Menopausal symptoms	50 per cent	50 per cent

¹ In "good results" in this class were included cases in which normal menstruation was established without pregnancy, and there were also cases in which pregnancy occurred. Pregnancy took place in 45 per cent of these cases, as noted in Table VI.

comply much. We, therefore, believe that if we have not obtained a satisfactory result after one series, the second series is not likely to alter the situation.

From this résumé, one is justified in stating that although this treatment is empirical, and its *modus operandi* not as yet understood, it is definitely worthwhile, and gives a fifty-fifty chance to those patients in whom all other methods have been tried and found wanting.

Referring to a résumé that we made in 1931 of only 38 cases, shortly after we began treating patients of this type, we note that our results at that time were practically the same on a percentage basis as in the present analysis.

Edeiken reports pregnancy established in 14 of 33 patients, which is approximately the same result as we obtained.

Friedman and Seligman report on nine consecutive cases of amenorrhea. Regular menstruation was re-established in all their cases, so that their results were better than ours in this type of endocrinopathy.

SUMMARY

1. The endocrine factors governing the normal menstrual cycle are briefly discussed.

2. The endocrine imbalance in the production of menstrual dysfunctions and sterility as related to the pituitary and ovary are enumerated.

3. One hundred and eight cases of various menstrual dysfunctions in single and married women, with and without sterility, treated by x-ray, are classified and thoroughly analyzed.

BIBLIOGRAPHY

1. CURTIS, A. H.: Textbook of Gynecology. W. B. Saunders Co., Philadelphia, 1938.
2. EDEIKEN, L.: Small Doses of X-ray for Amenorrhea and Sterility. *Am. Jour. Obst. and Gynec.*, 25, 511-516, April, 1933.
3. FRIEDMAN, ASA B., and SELIGMAN, BERNARD: X-ray Therapy in Amenorrhea. *RADIOLOGY*, 29, 99-103, July, 1937.
4. ISRAEL, S. L.: The Treatment of Dysfunctional Menstrual Disorders. *Endocrinology*, 22, 253-261, February, 1938.
5. KOTZ, J., and PARKER, E.: Treatment of Female Endocrinopathies. *RADIOLOGY*, 31, 66-72, July, 1938.
6. LITZENBERG, J. C.: The Endocrines in Relation to Sterility and Abortion. *Jour. Am. Med. Assn.*, 109, 1871-1873, Dec. 4, 1937.
7. LOEWENBERG, S. A.: Clinical Endocrinology. F. A. Davis Company, Philadelphia, 1937.
8. MACGREGOR, T. M.: Dysfunctional Uterine Bleeding Treated with Progesterone. *British Med. Jour.*, 2, 116-119, July 16, 1938.
9. MAZER, C.: Functional and Organic Derangements of the Hypophysis and Their Relation to Menstrual Disorders. *Med. Clin. of N. A.*, pp. 239-259, July, 1934.
10. MAZER, C., and GOLDSTEIN, L.: Clinical Endocrinology of the Female. W. B. Saunders Co., Philadelphia, 1932.
11. MAZER, C., ISRAEL, S. L., and CHARNY, C. W.: The Endocrine Factors in Human Sterility: The Evaluation of Diagnostic and Therapeutic Measures. *Pennsylvania Med. Jour.*, 41, 1009-1016, August, 1938.
12. NOVAK, E.: Endocrinology as Related to Gynecology. *Med. Leaves*, pp. 146-150. *Med. Leaves*, Inc., Chicago, 1937.
13. WERNER, A. A.: Endocrinology. Lea & Febiger, Philadelphia, 1937.
14. ZONDEK, B.: The Effect of the Follicular Hormone on the Anterior Hypophyseal Lobe. *Med. Leaves*, pp. 189-198. *Med. Leaves*, Inc., Chicago, 1937.

FEVER THERAPY IN GONOCOCCAL INFECTIONS¹

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SINCE 1930, the treatment of gonococcal infections by fever therapy has made rapid progress. Whitney's discovery that short wave transmitting apparatus could be used to elevate human temperature with safety was speedily adopted for this purpose (1). Since then, many important modifications of the original technic have been made. Yet, as has been pointed out before, the technic is always secondary to the skill and judgment of the physician administering the treatment (2). The classic work done by Warren, Carpenter, and others, of the University of Rochester, who carefully established thermal death times of more than 250 strains of gonococci, furnished the bacteriologic basis for the use of fever therapy in treatment of gonorrhea and its complications (3*a, b*).

The progress that has been made in the treatment of gonococcal infections by physically induced temperature rises has been due largely to one factor—thermolability of the gonococcus. This organism can be destroyed *in vitro* and *in vivo* at temperatures which human tissues can tolerate safely (4*a, b, c, d*). The value of temperature reactions in the treatment of gonorrhea and its complications has long been recognized. Various methods for inducing protein shock and temperature reactions were adapted to this work since Jau-regg's reports in 1918 (5). Satisfactory results with malaria (6*a, b, c*), typhoid (7*a, b*), as well as other foreign proteins (8*a, b*) have been described. Local heating of infected pelvic organs and gonorrheal joints with diathermy have also received favorable comment.

It should be pointed out that until the

advent of fever therapy, a constantly increasing variety of chemical gonococccides as well as other methods of treatment were advocated in gonococcal infections. The number and wide range of therapeutic attempts indicated the lack of universal success of any one method.

To more effectively destroy the gonococcus at its original site of invasion and spread in the pelvis, we have utilized a special combined technic. The concept of this technic was outlined by one of us in 1930 (9). The principle is to heat differentially and intensively the pelvic organs while the systemic temperature is maintained at or below 106.5° F. (41.4° C.).

Among the 165 cases of gonococcal infections presented in this report, there were 125 females and 40 males, with 40 cases of gonorrheal arthritis. About one-third of the females had salpingitis. All of them before treatment had positive spreads from cervix or urethra or both. All the cases included in this report gave definite bacteriologic evidence of the disease before treatment. Among the males, the usual complications of prostatitis (17 cases), involvement of the vas deferens (five cases), and epididymitis (eight cases) were present along with a positive urethral discharge. In the gonococcal arthritides, of whom 19 were females and 21 were males, the complement fixation on many occasions was found to be of great diagnostic importance. It should be pointed out that the incidence of arthritis in our series was much greater than that usually found because the futility of the usual treatment caused these cases to be referred to us.

TECHNIC

The effectiveness of the combined technic was more easily demonstrable in the

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female because of the ease with which the pelvic organs and genito-urinary tract could be heated thoroughly by means of the vaginal electrode.

The first step in the treatment was to elevate the systemic temperature. For this purpose, in our most recent method, we employed a combination of a horizontal photothermal cabinet placed over the patient, and short wave current heating.

Our photothermal cabinet contained twelve 60-watt carbon filament lamps controlled by switches so that two, four, or twelve lamps might be turned on or off at one time. The cabinet could be lowered or raised easily by means of an overhead pulley and counterbalancing weight system. The patient lay on a mattress placed on a wooden table. The cabinet covered the entire body, except for the head.

The preparation of the patient, after she had been examined to determine the absence of any contra-indication such as marked cardiovascular or pulmonary disease and the presence of gonorrhea, consisted of an enema and a light breakfast. The feet were wrapped in cotton and the legs were encased in special cotton leggings to prevent burns. Except for the leggings and a bed-sheet over her, the patient was nude.

Conversive heating energy of the short wave current was utilized to speed systemic temperature elevation. Two condenser pads, 12 × 16 inches each, were placed under the table so that one lay parallel to the region of the upper back and the other parallel to the area of the mid-thighs. These condenser pads were connected to short wave apparatus of the type employed for local routine treatments and which produced a current of 50,000 megacycles (6 meters wave length).

Within a period of about one and one-half hours, the temperature was elevated to about 106° F. (41.1° C.). At this point, the auxiliary energy of the short wave apparatus was discontinued and the intensive pelvic heating was begun. If, however, the patient had acute peritoneal inflamma-

tion, the local pelvic heating was deferred for an additional three or four hours.

The most effective method of applying local heat was found to be diathermy. Short wave currents could be used for this purpose. Originally, we utilized short wave currents for simultaneous systemic and differential pelvic heating. However, we found it possible to localize the heating effects of diathermy more accurately than with short wave. This was important because pelvic heating was maintained for from six to eight hours and when using short wave current energy for this period, occasionally overheating of the structures of the medial aspects of the thighs occurred. To avoid the painful sequelæ of such local overheating, we used the following dispersive diathermy electrodes: a metal belt and two metal cuffs of flexible lead tin composition metal. The metal belt was two and one-half inches wide and completely encircled the waist. A metal cuff was placed around each thigh. These three electrodes were connected to one terminal of the diathermy apparatus. The other terminal was connected directly to the vaginal electrode. A large metal electrode, 10 × 12 inches, was placed on the back of the patient so that it was in direct contact with the metal belt around the waist. This large electrode was used to further disperse the current. A milliamperemeter and a variable resistance were in the circuit of each of the three electric cords going to the three dispersive electrodes. With this arrangement, we could control and measure the amount of current energy flowing along each cable so that not too much energy was permitted to go through any one of the dispersive electrodes. After about three hours, the thigh cuffs were shifted to the calves. This shift was made also to avoid burns.

The vaginal electrodes were patterned after plaster casts made from numerous adult vaginas. After a large number of casts had been made, four sizes, varying from two and three-quarters to four and one-quarter inches in length, were adopted as standard patterns for the metal elec-

trodes. The metallic portion of the electrodes and their handles were channelled to permit the insertion of a special thermometer (10).

This thermometer served as the guide in determining the amount of the diathermy current applied. The mercury column of this instrument was visible for several feet as a result of special magnifying prisms on either side of the thermometer and could be read easily through the window of the cabinets (11). The thermometer scale was graduated in 0.2° F. (0.12° C.) and the markings widely separated to further facilitate accurate reading. The temperatures registered by this thermometer were kept between 109° and 110° F. (42.8° – 43.4° C.). The amount of diathermy usually required to maintain this reading ranged between 1,800 and 2,500 milliamperes. As a result of previous studies, we knew that the temperature of the pelvic organs was not less than 1.5° F. (0.9° C.) lower than the thermometer reading (10). The pelvic heating was usually maintained for six hours. The object of the higher pelvic temperatures was to achieve a more rapid lethal influence on the gonococcus (11). Carpenter and his co-workers have shown that various strains of this organism will resist a temperature of 106.7° F. (41.5° C.) for periods ranging from 6 to 30 hours (12). At 109.3° F. (42.9° C.), the thermal death time was cut to about half (13).

The rectal temperature was usually maintained at about 106° F. (41.1° C.). During the pelvic heating, systemic temperature was taken by oral and axillary thermometers. Before beginning pelvic heating, we determined the relationship between mouth, axillary, and rectal temperatures. Usually the mouth temperature is about 0.7° F. (0.42° C.) lower than the rectal.

The patient received fluids, either iced tap water or cold 0.6 per cent saline solution, as much as she desired. To minimize discomfort, sedation usually by means of gr. $\frac{1}{200}$ of hyoscine hydrobromide in combination with gr. $\frac{1}{6}$ of morphine sulphate, was administered. Small doses of mor-

phine were repeated when necessary. Close watch of a patient to avoid untoward effects was essential. Continuous observations were made of the color, pulse, and respirations. We believed it essential for a physician to be in continuous attendance. The treatment was usually terminated after 12 hours of sustained temperature. The rectal temperature usually returned to normal within an hour to an hour and a half. An intravenous injection of 5 per cent glucose in 1,000 c.c. of normal saline solution was frequently given after treatment to restore the chloride balance.

The preparation and technic for systemic elevation in the male were the same as those described for the female. However, in the male, the pelvic and genito-urinary tract heating were achieved by rectal diathermy maintained for two or three hours. The rectal mucosa was found to be much more sensitive to heating than the vaginal mucosa and when longer heating was attempted, rectal mucosal burns would occasionally result. In addition, thrombosed hemorrhoids would also complicate the situation as a result of prolonged presence of the electrode in the rectum. The use of the rectal electrode was found to be of great value in prostatitis. Because the heating of the anterior or penile portion of the urethra was not as effectual when only systemic temperature rises were used, a special technic for heating the penis was used. The penis was placed on the abdomen, and a small metal electrode 2.5×4.5 inches, of the same type of metal used in the dispersive electrodes in the female, was placed on the penis. It was kept in position by towels and a sandbag weight. The penile electrode was connected to one terminal of the diathermy apparatus. The other terminal was connected to a dispersive plate about 10×12 inches (25×30 cm.) in size and placed over the lower back, with the patient resting comfortably on it. By means of this arrangement, we were able to raise the penile temperature about 2° F. (1.2° C.) higher than the systemic temperature when using between 300 and 400 milliamperes of current. The usual

period for the administration of penile diathermy was four hours. As in the female, the male patients were kept under treatment for about 12 hours. In the male, however, we were able to follow the urethral spreads during the treatment. The fever was maintained for two hours after the spreads became negative, provided the treatment did not last more than 14 hours.

The necessity for re-treatment was determined by the presence of organisms in the cervical or urethral discharges on the day following the treatment. In the arthritis cases, re-treatment depended upon the clinical picture when the spreads were negative. If the spreads were negative, further daily examinations were continued for a short period. The necessity for re-treatment depended upon the thermal resistance of the invading organism and upon the immunity of the patient. When re-treatment was necessary, the shorter the interval between treatments, the more effective was the procedure. If the condition of the patient warranted, re-treatments were administered on alternate days.

CLINICAL RESULTS

Female.—Of 125 women treated by this technic, 117 (93 per cent) became bacteriologically free of gonococci. Our first group in this series consisted of 67 women who received from five to six hours of systemic hyperpyrexia combined with from three and one-half to four hours of additional pelvic heating. Of these, 62 were free of the gonococcus in an average number of 2.3 treatments per patient. The second group of these cases consisted of 58 women who received 12 hours of hyperpyrexia together with from six to eight hours of additional pelvic heating. In 55 of this group, the gonococcus disappeared after an average of 1.4 treatment per patient. More than two-thirds of the cases required but one treatment.

Within a few days following adequate treatment, there was a subsidence or disappearance of the vaginal discharge. The cervical secretion became mucoid and clear,

microscopically containing only scattered leukocytes instead of the pus clumps previously found. The urethral smear contained only scattered leukocytes in addition to many epithelial cells and Döderlein's bacilli. In a few cases, superficial mucosal burns caused a prolongation of the discharge, which disappeared with the healing of the mucosal area within two or three weeks. In a few other cases, a continuation of the discharge following disappearance of gonococci was caused by trichomonas vaginitis. This discharge ceased with the application of measures directed against the trichomonas.

About one-third of the cases were complicated by salpingitis. In the acute or subacute cases, pain usually disappeared during the first treatment. We observed that treatments might be instituted at any stage of gonococcal infection, even in the presence of acute salpingitis associated with fever and pelvic peritonitis. Tubo-ovarian inflammatory masses, including those which were probably suppurative and associated with a rapid sedimentation time, responded satisfactorily to this type of treatment. There was first a diminution or disappearance of pain, and a return of the temperature to normal the day following the treatment. The temperature remained normal. Rapid sedimentation rates became normal.

Pelvic examination within a few days after treatment usually revealed a marked diminution of pelvic tenderness, but little change in the size of the adnexal masses. From seven to ten days after treatment, there was usually an increased mobility of the uterus and some shrinkage of the inflammatory masses. About two weeks after the treatment, the adnexal masses became much smaller.

The first menstrual period following treatment sometimes came on before the expected time and was more profuse and of longer duration than usual. We never observed a cessation of menstruation or the occurrence of menopause symptoms after treatment. A number of patients with chronic salpingitis associated with painful

or prolonged menstruation, noticed that menstruation became more normal and less painful following treatment.

Pregnancies and normal deliveries occurred in a number of patients whom we had treated previously for gonorrhea by this technic. In a number of patients with acute salpingitis at the time of treatment, insufflation by the Rubin method subsequently demonstrated normal tubal patency.

The follow-up in most of these cases has been prolonged sufficiently (in some cases extending for a period of five years) to assure us that the disappearance of the gonococci has been permanent. We relied upon frequently repeated stained spreads, especially those taken directly after the cessation of menstrual flow. In addition, in many cases we made cultures. The danger of a woman becoming re-infected by resumption of relations with the sex partner who originally infected her or with some other infected individual was always kept in mind. In four cases, after intervals of many months during which repeated examinations failed to reveal the presence of abnormal discharge or of gonococci, a purulent discharge containing the organism was again found. In each of these cases, there was a definite history of new exposure with an infected partner.

Males.—In our series of 40 males, as in that of the females, we made no distinction between the acute and chronic cases. The reason for this was that the results with fever therapy depended more upon the thermal death time of the invading organism than upon duration of infection. Here, too, as in the female, the age factor was of no great consequence except that, should a patient have been too old, as evidenced by advanced arteriosclerosis or other major degenerative changes, treatment would have been refused. However, since all our patients ranged between 19 and 50 years of age, we never found it necessary to refuse treatment to a patient with gonorrhea.

Before male patients were subjected to treatment, the routine diagnostic procedures were completed and the extent of in-

volvement was determined. Spreads, two glass tests, complement fixation, etc., were used. The effect of fever treatment during the course of each treatment upon the male patient was apparent. During the first half or three-quarters the purulent discharge would become much more profuse and then begin to thin out until it was very thin and watery. The typical intracellular organisms would become extra-cellular, then enlarge in size, apparently undergoing autolysis, and finally the staining characteristics were changed. At the end of a successful treatment, the smears would be completely negative and the thin watery discharge would contain only a few pus cells and many epithelial cells without even a trace of extra-cellular organisms. Twenty-four hours after the completion of a successful treatment, there was little or no discharge and the patients were completely free of such complaints as burning, frequency, and urgency. In the cases of epididymitis, the pain and swelling subsided directly after treatment. Of the 40 males, 28 became gonococcus-free in from one to three treatments. The average number of treatments required for these cures was 2.8 treatments per patient. Of the remaining 12, six were improved and subsequently responded to local chemical treatments by gonococcocides within three weeks. There were six total failures, the subsequent course of which, after treatment, showed that they apparently had not been influenced by fever therapy. These failures were probably due to two factors: the lack of sufficiently intense anterior urethral heating or an inadequate period of sustained systemic temperature. Some of these failures were due to the patient's refusal to undergo a second or third treatment, and in one case the patient's emotional reaction to the treatment was so marked that it was considered wiser to use other methods.

As in the female series, the importance of follow-up was also stressed. The usual provocative tests—alcohol and chemical irritation—were utilized.

Gonorrheal Arthritis.—Not only can con-

trolled effective heating by physically induced fever be applied to the pelvic foci, but the blood stream and metastatic joint lesions such as are present in gonorrheal arthritis can be attacked simultaneously. In addition to the devitalizing and lethal action of the heat directly on the gonococcus, there are other important defensive measures evoked by fever therapy. Some believe that fever stimulates immune reactions and cases have been cited in which patients spontaneously clear themselves of the gonococcus within a short period after fever treatment (15). Certain beneficial systemic effects such as increased circulation, speed, increased white cells, and phagocytes in the blood stream (16a, 6c) were also achieved with the elevation of systemic temperature. The application of physically induced fever for gonorrheal arthritis represented an important advance, permitting the physician to control the height and duration of the patient's temperature reactions at all times. The successful application of this method in gonorrheal arthritis has been the subject of numerous reports (17, 4a, 16a, 16b, and 16c).

Each of the 40 cases in this series was proven to be an arthritis of gonococcal origin. Of this group, 19 were females and 21 were males. The average number of treatments administered was 2.69; eight had one treatment, and all but one of these eight made complete recoveries. The largest number of treatments given any one patient was seven.

The response of the systemic and joint manifestations of nearly all the cases was satisfactory and frequently dramatic. The temperature elevations which the patients ran before treatment subsided, and malaise and chills and sweats, when present, disappeared. Red-cell sedimentation rates showed trends to normal and patients were able to get out of bed within a short period after treatments. Joint symptoms in all but eight of the 40 cases subsided with remarkable uniformity immediately after termination of treatment. In all cases, in-

cluding these eight, there was a definite change for the better.

With the type of treatment kept in mind, this series of 40 cases may be subdivided into two categories. The first 16 were treated before we began 12- to 14-hour sessions. This group was subjected to physically induced fever in sessions lasting but from six to eight hours. Of these 16, seven were cured with all evidence of pelvic and joint involvements permanently eradicated 24 hours after treatment. In the series of 24 cases treated by the prolonged technic, similar results were achieved in 16 cases. Thus, a total of 23 patients were cured of their gonorrheal arthritis with physically induced fever alone.

Of the remaining 17 patients, there were nine who were definitely and markedly improved but who required some local treatment to free them of pain completely and to restore total mobility. The local treatments consisted of diathermy, short wave, bakings, massage, and corrective exercises.

The failure to achieve satisfactory results in eight cases was due to several factors: two cases came for treatment with permanent bony ankylosis (x-ray evidence); four had inadequate treatments, that is, too short, and the temperature did not exceed 105.5° F. (40.8° C.); one, a female, had recurrence of pain and positive smears three weeks after discharge from the hospital and the possibility of re-infection by her consort was probable, and one patient was infected by a resistant organism which would not yield despite long intensive fever treatments.

It should be noted that organisms not killed by fever appeared to be attenuated so that short courses of chemical after-treatment for about three weeks could easily eliminate the original focus.

In gonorrheal arthritis, the duration of the disease before treatment was a factor that apparently affected the response to treatment. Generally, we found that the longer the chronicity, the less rapid was the response. The danger of permanently damaged joints was also greater with increased duration. After-treatments to re-

THE OCCURRENCE OF TWO OR MORE PRIMARY MALIGNANT LESIONS¹

By J. J. COLLINS, M.D., *Thomasville, Georgia*

THE term "multiple primary malignancy" denotes the occurrence of two or more primary malignant lesions in an individual. Such lesions may be present concurrently, or one may antedate the other by any length of time. Lesions such as multiple myeloma, Ewing's tumor, lymphosarcoma, etc., which are of multiple character in practically all instances, are excluded.

The occurrence of multiple primary malignancy is not rare. The earliest recorded case is that of Billroth (8), in 1869. Since then, many cases have been reported and several comprehensive reviews of collected cases have been made. Very few articles on this subject, however, have appeared in the radiological publications, and for that reason I have taken this opportunity to review briefly the literature and to report a few cases of my own.

Major (1), in 1918, collected 220 cases from the literature and added one of his own. It is noteworthy that practically all of his collected cases had been reported by foreign authors.

Hanlon (2), in 1931, reported a series of 49 cases from the Mayo Clinic. He concluded from his findings that multiple primary neoplasms probably represented incidental occurrence rather than a definite response to any law of neoplastic formation. He also noted in his cases that multiple carcinomas occurred among persons whose average age was greater by several years than those having only a single lesion.

Warren and Gates (3), in 1932, published an excellent and most extensive survey of the literature. They collected 1,219 cases which they accepted as authentic, and added to this number 40 cases of their own. They rejected 37 reported cases which they were not able to verify.

In their summary of this comprehensive analysis they stated that the frequency of multiple malignancy was 1.84 per cent of all cancer cases. On the basis of American statistics, the frequency was 3.9 per cent. In their own series of 1,078 cancer autopsies, the frequency was 3.7 per cent. They concluded that multiple malignant tumors occur more frequently than can be explained on the basis of chance alone and that a predisposition from some unknown cause may be the factor in producing multiple malignant lesions. In regard to age, they found multiple and single lesions occurring at about the same average period of life.

Hurt and Broders (4), in 1933, reported 71 cases of multiple malignant neoplasms found in 2,124 patients with cancer treated at the Mayo Clinic, in 1929. This is an incidence of 3.4 per cent. They found a family history of cancer in 28.6 per cent of the cases reported. In their conclusions they state: "Persons are more likely to have more than one primary malignant neoplasm than a survey of the literature would lead one to believe."

Schreiner and Wehr (5), in 1934, reported 307 cases of multiple malignancy among 11,212 cases of neoplasms seen at the State Institute for the Study of Malignant Disease, at Buffalo, an incidence of 2.7 per cent.

Bugher (6), in 1934, reported 30 cases of multiple neoplasms found in 983 cancer autopsies at the University of Michigan Hospital, an incidence of 3.1 per cent. He concluded that the frequency is greater than can be attributed to incidental occurrence.

Mead Burke (7), in 1936, reported a series of 46 cases of multiple neoplasms found in 583 postmortem examinations showing cancer. This is an incidence of 7.8 per cent and is the highest noted.

From reports above cited, it is evident that the frequency of multiple malignancy

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, Pittsburgh, Nov. 28-Dec. 2, 1938.

varies in different series between 2.7 and 7.8 per cent of all cancer cases. Determination of the absolute incidence is somewhat difficult. All cases must conform to some standard criteria. To this end, Billroth (8) formulated three postulates to be observed in establishing a diagnosis of multiple malignancy: (1) Each tumor must have an independent histologic appearance; (2) the tumors must arise in different situations, and (3) each tumor must produce its own metastasis.

Such stipulations, however, seemed to rule out numerous authentic cases so that the suggestions of Goetze (9) have been followed in more recent years. His criteria were as follows: (1) The macroscopic and microscopic appearance of the tumors must be that of the usual carcinomas of the organs involved; (2) exclusion of metastasis must be certain, and (3) diagnosis may be confirmed by the character of the metastasis in each case.

While conformation to such standards will limit errors of commission, so far as a positive diagnosis is concerned, there exists also the possibility of errors of omission in series of cases reported either from autopsy or clinical material.

In postmortem cases, a most thorough examination of all tissues must be made to avoid overlooking a second primary growth which may be extremely small and difficult to discover. In the pathologic examination of a single organ, if multiple sections are not made, a second malignancy of different type may remain undiscovered. The history of the patient must also be reviewed thoroughly to determine if he may have had a previous malignancy which was treated and cured.

The incidence in a series of cases reported from clinical material may be in error due to failure to diagnose a second primary lesion because of its small size, inaccessibility, or absence of symptoms. The clinician may fail to take steps to differentiate a second primary from a metastatic lesion if he does not bear in mind the possible presence of multiple neoplasms.

Multiple primary malignancy involving practically every combination of organs has been reported. Numerous cases involving a single organ, paired organs, or organs of the same system have likewise been recorded. Hurt and Broders (4) state that multiple primary malignant lesions occur most commonly in the same organ or in organs of the same system. Numerous cases of multiple neoplasms have been reported in the colon. The rôle of polypi in malignancy of the large bowel may be accountable for this.

The skin is a common location for one or more lesions. Many cases involving the lips and buccal mucosa or pharynx have also occurred. Irritation, of course, may be a large factor here. Then, also, if the probability of recovery from a surface malignancy is good, the patient has a chance to live long enough in some cases to develop a second malignancy.

It is generally agreed, that the incidence of multiple malignancy is too great to be ascribed to accidental occurrence and that some unrecognized factor of susceptibility may be the cause of its development. In regard to the part played by heredity, age, or sex, no definite information can be gained from the reported cases. In cases in which the family history has been given, the hereditary factor has been positive in from 25 to 30 per cent in some series. The average age and sex distribution has varied too greatly in different series to be of value. Nothing which points to any predictable innate, individual susceptibility has been found. The closest approach to this is the statement of Hurt and Broders (4) that: "If a person has one malignant tumor, the probability of the development of another malignant tumor varies directly with the grade of malignancy of the first tumor, presuming that the person survives long enough for another malignant newgrowth to develop."

CASE REPORTS

Case 1. L. H. B., white male, 51 years of age, was admitted to the John D. Archbold Hospital on April 28, 1931, because of a mass the size of a large orange in the

left axilla. There was no family history of cancer. Nine months previously he had noted a small hard tumor in the left axilla. There was no change in its size until three months before the date of admission, when it began to grow rapidly. It now interferes with movement of the arm.

Examination showed the mass in the axilla to be 8 cm. in diameter, exceedingly firm, and not attached to the skin or chest wall. No other evidence of disease was found.

The tumor was excised and microscopic examination proved it to be a reticulum-cell sarcoma. Deep x-ray therapy was given post-operatively.

The patient remained well until March, 1934, almost three years later, when he developed an intestinal obstruction after a few days of colicky pain in the abdomen. He was admitted to the hospital on March 19, 1934. Laparotomy was done. Three distinct tumor masses were found distributed throughout the ileum. The serosa over the tumors was practically normal in appearance. Two of the tumors were identical in size (5 cm. in diameter); the third, and most proximal in location, was about 4 cm. in diameter and had caused an intussusception with consequent intestinal obstruction. Each of the three lesions was separated by several feet of normal-appearing intestine. No evidence of metastases was found in the liver or mesenteric glands. Each of the lesions was removed with wide margin of normal bowel by separate excision and anastomosis.

Pathologic examination showed all lesions to be adenocarcinoma. Sections from one tumor appeared to be identical with those from the others.

The patient made an uneventful recovery and was discharged from the hospital three weeks later. He remained in good health until 15 months later, June, 1935, when he began gradually to lose strength. He was admitted again to the hospital on Oct. 3, 1935, at which time he had an extremely severe secondary anemia, a palpable, nodular liver, and a very defi-

nately palpable mass in the right lower quadrant. He refused to have x-ray studies made and was dismissed from the hospital. Death occurred in November, 1935. Permission for postmortem examination could not be obtained.

This patient had at least two primary malignancies, one of which was apparently cured. If each of the lesions in the small bowel can be accepted as being primary, then he had four primary malignancies. The clinical findings on his last admission to the hospital suggested the presence of a malignancy in the cecum or ascending colon. It is possible that a neoplasm had developed there, but this, of course, is purely conjectural and cannot be considered to bear any weight in the case.

Case 2. Mrs. C. M. S., 21 years of age, was admitted to the John D. Archbold Hospital on Aug. 23, 1937, for deep therapy of a recurrent pelvic tumor. There was no family history of malignancy. She had had one pregnancy, with normal delivery 18 months previously. Postpartum recovery was good. In January, 1937, she noted some enlargement of the abdomen. A diagnosis of pregnancy was made by her physician. The abdomen continued to enlarge but menstrual periods did not cease. In May, 1937, a diagnosis of ovarian tumor was made and operation disclosed a very large cystic tumor of the right ovary. Microscopic section proved this to be a granulosa-cell tumor of the ovary, of sarcoma type. Three months after operation a recurrent mass was noted in the right side of the pelvis by the patient. She then came to the hospital for x-ray therapy.

Examination at this time revealed a firm, smooth, tender mass 7 cm. in diameter, fixed in position in the pelvis just to the right of the midline. Several very small subcutaneous nodules were found in the region of the scapulæ and one slightly larger nodule just under the skin in the left axilla. A small scar was noted at the base of the neck posteriorly. Questioning the patient in regard to this brought out the history that a small black

mole, which had been present from birth, had suddenly begun to grow and had become irritated in August, 1936. It had been removed at once with the actual cautery by her family physician.

Two of the small subcutaneous nodules were removed for biopsy and a diagnosis of metastatic, non-pigmented melanosarcoma was made.

Deep x-ray therapy was given over the pelvic tumor. It regressed to about 50 per cent of its original size but did not disappear entirely. In October, 1937, the patient developed severe headaches, mental confusion, projectile vomiting, and rapid loss of vision. Examination of eye grounds showed changes in visual fields and bilateral choking of the disks. Death occurred March 21, 1938. No postmortem examination could be obtained.

This patient, 21 years of age, had a granulosa-cell tumor of the ovary and concurrently a melanoma of the skin with metastases. It seems probable that the cerebral lesions were secondary to the melanoma.

Case 3. Mrs. J. A. P., 48 years of age, was admitted to the John D. Archbold Memorial Hospital on June 4, 1930, with a history of vaginal bleeding which had been continuous for three months. There was no family history of cancer.

Examination revealed an ulcerated lesion of the cervix which proved to be squamous-cell carcinoma. There was no

infiltration of the vaginal vault or parametria. Intensive radium therapy was given and the lesion regressed entirely. The patient continued in good health until July, 1938. She then noted a small tumor mass in the soft tissue of the deltoid region of the right arm. This mass increased in size and became somewhat painful, until it was excised in October, 1938. Microscopic examination proved this to be a fibrosarcoma, apparently arising from a muscle sheath.

The three cases reported were the only cases of multiple malignancy found in a series of 176 clinical cases of cancer in which an internal organ was involved, and in which the multiplicity was not due to basal-cell or squamous-cell carcinoma of the skin.

REFERENCES

- (1) MAJOR: Quoted by Burke.
- (2) HANLON, F. R.: Multiple, Primary Carcinomas. *Am. Jour. Cancer* (supp.), 15, 2001-2012, July, 1931.
- (3) WARREN, SHIELDS, and GATES, OLIVE: Multiple Primary Malignant Tumors. *Am. Jour. Cancer*, 16, 1358-1414, November, 1932.
- (4) HURT, H. H., and BRODERS, A. C.: Multiple Primary Malignant Neoplasms. *Jour. Lab. and Clin. Med.*, 18, 765-777, May, 1933.
- (5) SCHREINER, B. F., and WEHR, W. H.: Multiple Primary Cancer as Observed at the State Institute for the Study of Malignant Disease. *Am. Jour. Cancer*, 20, 418-424, February, 1934.
- (6) BUGHER, J. C.: Probability of the Chance Occurrence of Multiple Malignant Neoplasms. *Am. Jour. Cancer*, 21, 809-824, August, 1934.
- (7) BURKE, MEAD: Multiple Primary Cancers. *Am. Jour. Cancer*, 27, 316-325, June, 1936.
- (8) BILLROTH: Quoted by Burke.
- (9) GOETZE: Quoted by Burke.

RADIOSENSITIVITY AND RECURRENT GROWTH IN *OBELIA*

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ONE of the outstanding properties of living matter is its wide variation in susceptibility to radiation, such as roentgen and gamma rays. Whereas, some cells are able to withstand several hundred thousand roentgens, others will succumb to doses of only a few such units of radiation. In our experience, growth has been observed to occur in seedlings which have been subjected to doses as high as 200,000 r, while killing has been observed to take place in frog's eggs which have received doses of less than 50 r. The most sensitive cell reported, so far as we know, is that of the chick *Allantois* irradiated *in vitro*. According to Scott (12), this cell may be killed by exposure to doses as low as two roentgens.

As early as 1906, Bergonie and Tribondeau (1) compared the relative radiosensitivity of tissues in various states of activity and formulated the well-known law which bears their names. This, in effect, states that cells which are embryonic in character, and more active in growth and mitosis, are more vulnerable to radiation. While there are many reports on record which illustrate the wide difference in susceptibility of cells to radiation, there are relatively few that deal with the changes which organisms may undergo during their life cycles, and among these the findings differ.

Mottram (11), in 1913, took advantage of the fact that mitosis is more prevalent in *Vicia faba* at night than during the day and found these to be the most sensitive organisms when mitosis was at a peak of activity. Similarly, Körnicke (9), in 1915, found a correlation between growth and radiosensitivity when the susceptibilities of dormant and germinated seeds were compared. Thus, these experiments tend to support the law of Bergonie and Tribondeau.

In 1923, Mavor (10) determined the

susceptibility of *Drosophila melanogaster* to x-rays during part of its life cycle and found it to be practically constant during the larval and part of the pupal stages, but the latter part of pupal development was attended by a sudden and marked increase in resistance. Recently we have confirmed this work and expanded it considerably (unpublished) and found that the changes in radiosensitivity cannot be correlated with the important developmental events. The results, therefore, appear to be at variance with the law of Bergonie and Tribondeau.

Changes in radiosensitivity of *Drosophila* embryos have also been followed (Henshaw and Henshaw, 6, 1933). It was found that, whereas, the organisms become gradually more sensitive during blastulation, they suddenly become several times more resistant at or near the time of gastrulation. Similar changes have been observed in *Calliphora* by Scott (13, 1934). In view of the fact, in these cases, that the rate of mitosis is practically logarithmic, and the fact that mitotic activity is greatly reduced in most of the cells at the time of gastrulation, these experiments may be said to be in accord with the law of Bergonie and Tribondeau.

Sugiura (14), in 1937, measured the relative radiosensitivity of Mouse Sarcoma 180 irradiated *in vivo* and *in vitro* and found the cells to be about twice as resistant when treated outside the body. Henshaw and Sugiura (8), in 1936, and Goldfeder (2), in 1938, exposed cells of the same tumor when grown *in vivo* and in tissue culture, and found that cells in tissue culture would show some growth into the plasma medium after receiving from 10 to 20 times the dose lethal to the same cells irradiated in the animal. In these cases, it is difficult to see how the law of Bergonie and Tribondeau could apply.

A number of experiments have been

carried out in which growth activity has been controlled and the radiosensitivity measured under the various conditions. In this laboratory (Henshaw and Francis, 6, 1933), we have regulated the growth of *Triticum* seedlings and determined their susceptibility to x-rays.¹ It was found, on the one hand, that growing seedlings were more sensitive than non-growing dry seeds (thus confirming Körnicke's experiment mentioned above), and, on the other hand, that growing forms, rendered non-growing by subjection to low temperature, did not become more resistant as a result. Further, it was found that stopping growth by drying increased the resistance considerably, whereas, stopping it by asphyxiation increased it only slightly.

Thus, practically all degrees of relationship between growth activity and radiosensitivity have been observed and it is apparent that further study under more favorable conditions is needed.

Recently, it has been our opportunity to investigate the relationship of growth activity and radiosensitivity in the form *Obelia* in which various types of growth activity are manifest and sharply defined. In a succession of easily recognizable stages, this form displays predominantly proliferation, differentiation, organization, dedifferentiation, and regression. Moreover, being colonial and having individuals in all stages of development present at one time, it was a simple matter to apply radiation in varying amounts to colonies and observe the relative effects at different stages and on different kinds of growth activity.

The idea of using *Obelia* for radiobiologic studies came from Hammett's recent work (3, 4, 5) in which he used this organism to test the influence of certain compounds on various phases of growth. The form to be described here was the same as that used by Hammett—*Obelia geniculata*. This investigator has emphasized the confusion

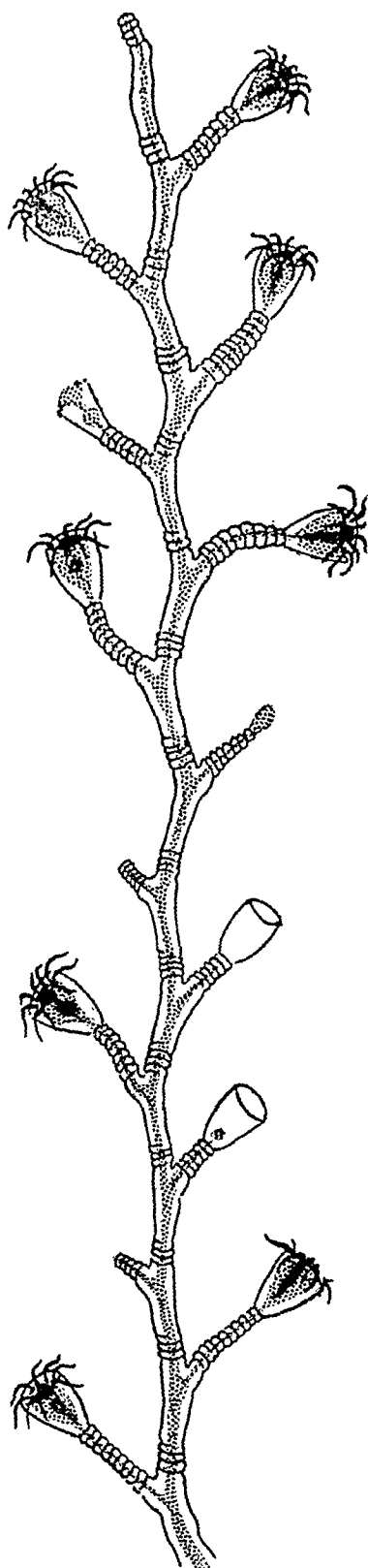


Fig. 1. Hydrocaulus of *Obelia* colony showing cut end at base, branching pedicels, and hydranths in various stages of development.

¹ The reader is referred to our previous article for a review of the investigations in which growth rate was regulated and radiosensitivity followed.

that exists in connection with the taxonomy of *Obelia* and has pointed out that from the literature one might easily mis-

attached to the substratum. At intervals, this gives off upright branches known as *hydrocauli*. These branches, carefully

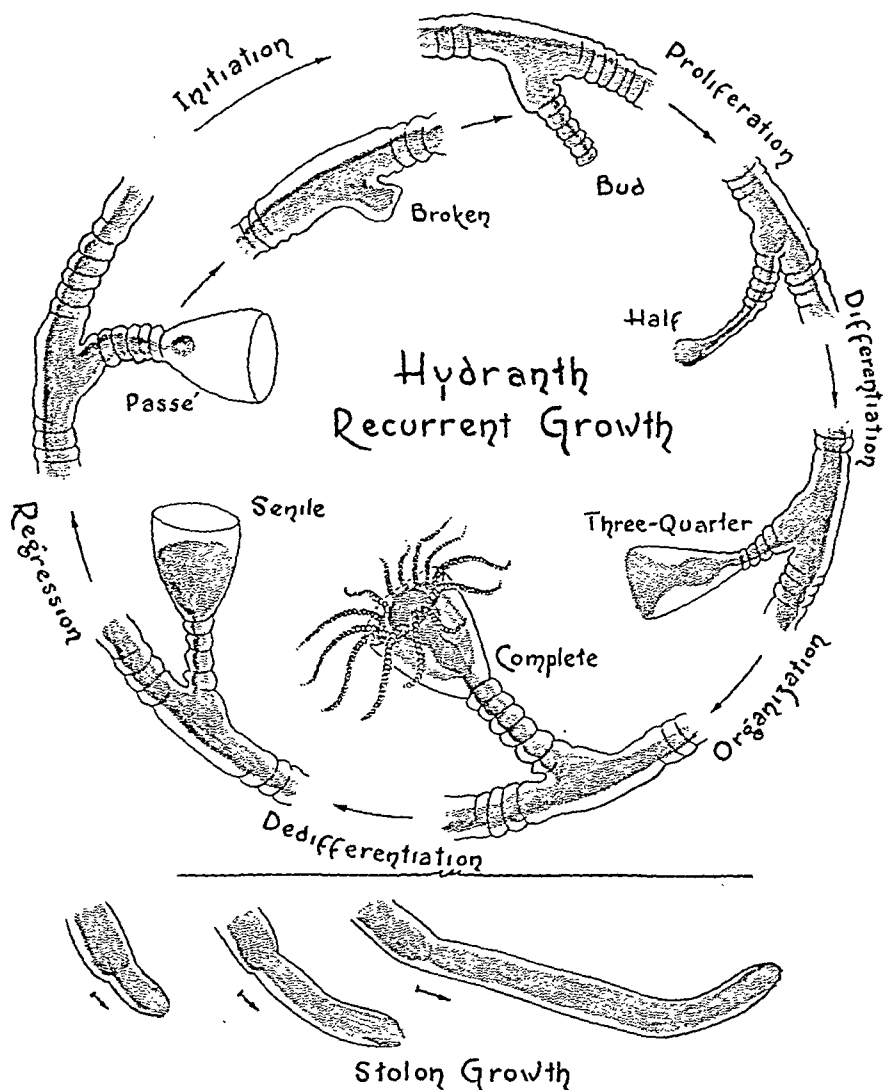


Fig. 2. Above, diagrams showing the cycle of recurrent growth of hydranths of *Obelia*; below, diagrams of stolon regeneration.

take *O. geniculata* and *O. dichomata*. However, in view of the fact that we have used both forms and found the same general relationships for the points to be discussed, no serious error can develop from a dispute over classification.

Obelia is a colonial co-elenterate which lives in the sea. Usually, it may be found just below tide level as small, gray plant-like masses attached to wharves, floats, or rocks along the shore. The colony consists of a basal stem or *hydrorhiza* which is

cut away with scissors and allowed to drop into a dish of clear sea water, are the specimens used for experimentation (Fig. 1).

The *hydrocauli* follow a zigzag course and at every bend give off a side branch or *pedicel*. The hydrocaulus stems are usually from one to two centimeters long and have pedicels numbering up to fifty or more. The pedicels are annulated and give rise at the tips to polyps or *hydranths*. These arise as buds, largely by proliferation, which grow and differentiate to form

the elaborate hydranth with from twenty to thirty tentacles, a mouth, and a gastro-vascular cavity. As such, the hydranth is

contributed in no way to the investigation carried out, no description of them need be given here. At the cut ends of the hy-

15,000 r

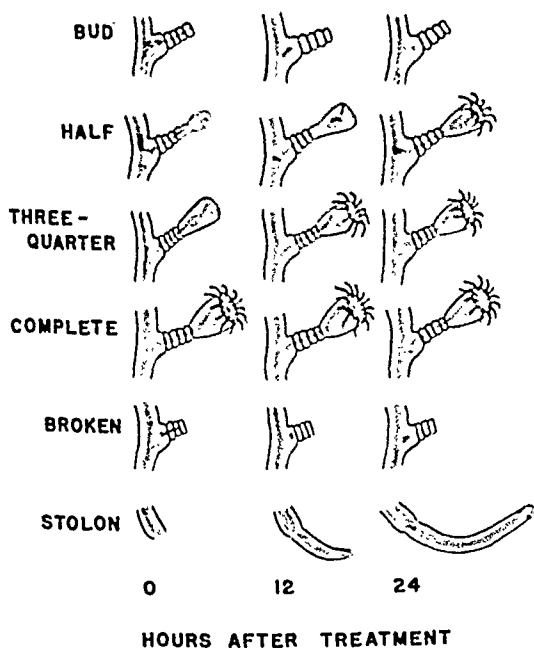


Fig. 3.

Fig. 3. Diagrams showing the influence of 15,000 r doses of x-rays on hydranths and stolons of *Obelia*.

25,000 r

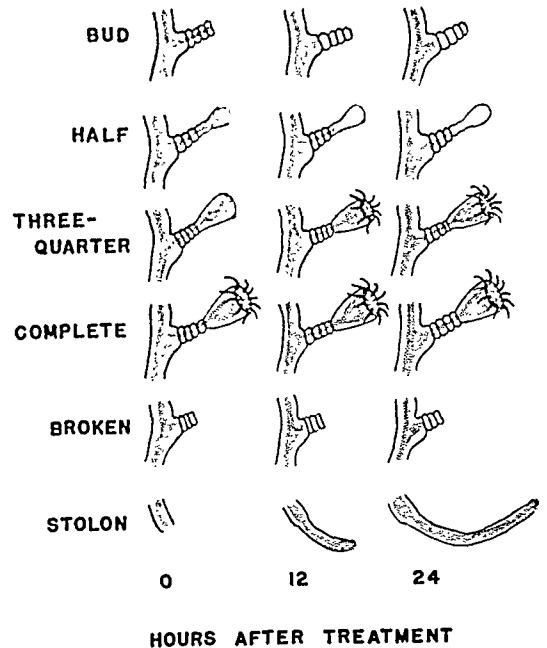


Fig. 4.

Fig. 4. Diagrams showing the influence of 25,000 r doses of x-rays on hydranths and stolons of *Obelia*.

a complete, functioning unit, fully capable of self-maintenance. It is connected to the other hydranths only by way of the pedicel and hydrocaulus.

The hydrocaulus and pedicel are made up of two layers: (1) the outer chitinous layer, or *perisarc*, which lends rigidity to the stem, and (2) the inner layer, or *cenosarc*. The *cenosarc* is made up of soft tissues, is composed of two layers of cells, has a lumen which is continuous throughout the hydrocaulus and pedicels, and connects with the gastrovascular cavities of the various hydranths. The *cenosarc* cavities are lined with cilia which keep the *hydroplasmic fluid* within, in constant motion. The flow is easily visible because of the abundance of highly refractal bodies carried along by the *hydroplasm*. In addition to hydranths, there are also gonopores which have to do with reproduction of the form, but since they

drocalculi, a new organ of attachment or *stolon* is usually formed by outgrowth.

When the material was brought into the laboratory, it was washed free of débris and straight stems with pedicels varying in number from five to forty were selected. These then were kept separately in stender dishes in 20 c.c. of sea water which was changed three times every 24 hours.

The specimens, therefore, had the general appearance indicated in Figure 1, in which the pedicels supported hydranths in various stages of development. If these are watched closely over a period of two or three days, they will be seen to manifest the cycle of change shown in Figure 2, a behavior spoken of as *recurrent growth*. Our impression of this phenomenon is the same as that of Hammett's, except for certain unimportant details, so that we shall use the same descriptive terminology as used by Hammett.

The *bud*, by proliferation mainly, changes into the stage spoken of as *half* (half full size). This, by differentiation, changes to the *three-quarter* stage and the *three-quarter*, by organization, to the *complete*. The complete stage is the fully formed, feeding individual or hydranth, and as such, exists for a much longer period than the other stages. However, after a few days of active existence it undergoes dedifferentiation and regression until that individual, *per se*, no longer exists. Later, however, a new bud will form on the same pedicel and the cycle is repeated—recurrent growth. The regeneration of stolons in these forms is spectacular, for within 48 hours stolons longer than the entire hydrocaulus may be formed. The growth, in fact, is so rapid that it may actually be seen to progress across the low-power field of a compound microscope. Watching this is much like watching the movement of the minute hand on a clock.

Thus, in order to compare the relative radiosensitivity of cells manifesting these

various types of growth activity, it was necessary only to irradiate specimens such as the one shown in Figure 1 and keep a record of subsequent development. Such records have been made for nearly a hundred colonies receiving various doses of x-rays.

The work was carried out at the Marine Biological Laboratory, Woods Hole, Mass., during August and September, 1935, making use of the new high intensity dual tube x-ray equipment available there. The conditions of treatment were as follows:

195 kv.
30 ma.
14 cm. dist. (from either target to test material)
0.75 mm. copper
1.62 mm. aluminum } filter
2,000 r/min.

For the points we wish to make, it seems best to present the results in chart form, which has been done in Figures 3, 4, 5, and

40,000 r

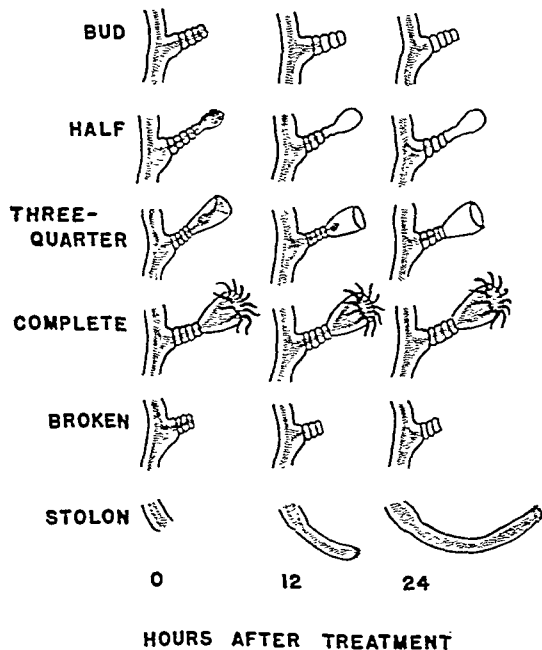


Fig. 5.

Fig. 5. Diagrams showing the influence of 40,000 r doses of x-rays on hydranths and stolons of *Obelia*.

250,000 r

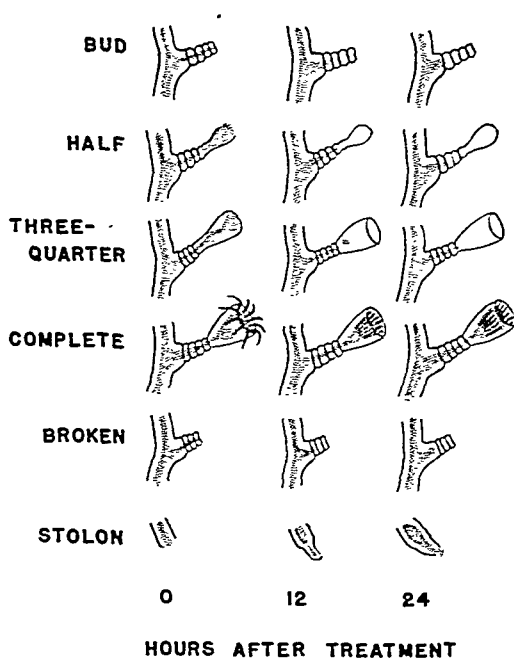


Fig. 6.

Fig. 6. Diagrams showing the influence of 250,000 r doses of x-rays on hydranths and stolons of *Obelia*.

6. It will be seen that around 15,000 r is required to suppress initiation and stop growth in the bud; that 25,000 r is required to stop growth at the half stage; that 40,000 r is required to stop it at the three-quarter stage, and that 250,000 r is required to suppress hydranth activity and stolon growth. Thus, neglecting stolon growth for the moment, it appears that the cells of *Obelia* are the most vulnerable to x-rays when in, or about to enter, active proliferation and that they become more resistant as differentiation progresses. The results,

growth, three things caused us to believe that it could best be characterized as a type of metaplasia rather than hyperplasia. First of all, the rate of growth as indicated above seemed entirely too rapid to indicate proliferation. Secondly, cells near the tip of the stolon may be observed, under the microscope, to be moving distally. Thirdly, as indicated in Figure 7, the cenosarc is drawn out of the hydrocaulus by the advance of the stolon. If these points can be taken to mean that proliferation does not occur to any appreciable ex-

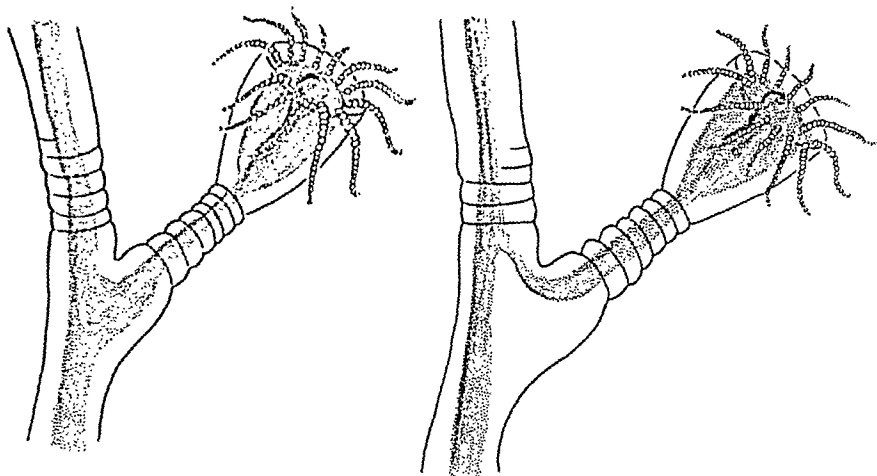


Fig. 7. Diagrams indicating that stolon growth results mainly from a flowing of coenosarc cells into the stolon. Occasionally, the polarity of these organisms will become reversed and a stolon form at the distal end of the hydrocaulus. The drawing at the left shows the configuration of coenosarc in normal organisms when the upper branch forms a hydranth. The drawing at the right shows this when the upper branch supports an actively growing stolon. The thinness of the coenosarc strand and the unusual position of the branch of coenosarc are taken as evidence that coenosarc material is being pulled out into the branch when a stolon is formed.

in this respect, are in strict accord with the law of Bergonie and Tribondeau.

The behavior of the rapidly growing stolon, on the other hand, seemed diametrically opposed to this condition, for, as indicated, as much radiation was required to check its progress as was required to stop normal maintenance activity in the most mature form. Observing such resistance, however, caused us to give further attention to the type of growth manifest by the stolon.

While facilities were not available, and it was not possible actually to make sections to see whether or not proliferation formed the major part of the stolon

tent in stolon growth, then even stolon cells may be said to respond to radiation in accord with the law of Bergonie and Tribondeau, thus making all responses observed in *Obelia* consistent in this respect.

SUMMARY

1. The hydranths of the colonial form *Obelia* manifest the phenomenon of recurrent growth. They, therefore, display in succession stages which are predominantly characterized by proliferation, differentiation, organization, dedifferentiation, regression, and initiation.

2. Hydranths in various stages of

growth and development were subjected to varying amounts of radiation and their susceptibility determined.

3. It was found that the organisms were the most susceptible when in, or about to enter, the stage of active proliferation, that they became more resistant as development progressed, and that they reached a peak of resistance in the most mature stage.

4. The responses of hydranths to radiation, therefore, appear to be in strict accord with the law of Bergonie and Tribondeau for the normal conditions of growth and development.

5. The rapidly regenerating stolon, on the other hand, was found to be relatively very resistant, and, therefore, at variance with the law of Bergonie and Tribondeau. However, consideration of the nature of the regenerative growth revealed that what appeared to be rapid proliferation was probably, in reality, little more than a change in cell position or, at the most, change in cell type. Thus, while there is some question connected with the stolon response, it cannot be said to be at variance with the law in question.

Acknowledgments: The writer wishes to thank Dr. G. Failla for his interest and suggestions in connection with this work, and Mr. Joseph C. Bender, for the drawings which appear here.

REFERENCES

- (1) BERGONIE, J., and TRIBONDEAU, L.: Interprétation de quelques résultats de la radiothérapie. *Compt. rend. Acad. d. Sc.*, 143, 983, 984, 1906.
- (2) GOLDFEDER, ANNA: Studies on the Effect of Radiation upon Growth and Respiration of Various Tissues *in vitro*. *RADIOLOGY*, 31, 73-80, July, 1938.
- (3) HAMMETT, F. S.: The Influence of Sulfhydryl and its Suboxidized Derivatives on the Developmental Cycle of Hydranths of the Genus *Obelia*. *Protoplasma*, 19, 510-540, 1933.
- (4) HAMMETT, F. S., and PADIS, K.: Correlation between Developmental Status of *Obelia* Hydranths and Direction of Hydropasmic Streaming within Their Pedicels. *Protoplasma*, 23, 81-85, 1935.
- (5) HAMMETT, F. S.: Developmental Growth and the Amino Acids. *Protoplasma*, 23, 326-336, 1935.
- (6) HENSHAW, P. S., and HENSHAW, C. T.: Changes in Susceptibility of *Drosophila* Eggs to X-rays. I.—A Correlation of Changes in Radiosensitivity with Stages in Development. *RADIOLOGY*, 21, 239-251, September, 1933.
- (7) HENSHAW, P. S., and FRANCIS, D. S.: A Consideration of the Biological Factors Influencing the Radiosensitivity of Cells. *Jour. Cell. and Comp. Physiol.*, 7, 173-195, December, 1935.
- (8) HENSHAW, P. S., and SUGIURA, K.: Radiosensitivity of Mouse Sarcoma 180 Irradiated *in vivo* and *in vitro*. Report of the International Cancer Research Foundation, 4, 25, 26, 1936.
- (9) KÖRNICKE, H.: Ueber die Wirkung verschiedener starker Röntgenstrahlen auf Keimung und Wachstum bei den höheren Pflanzen. *Jahrb. Wiss. Botan.*, 56, 416, 1915.
- (10) MAVOR, J. W.: Studies on the Biological Effects of X-rays. *Am. Jour. Roentgenol. and Rad. Ther.*, 10, 968-974, December, 1923.
- (11) MOTTRAM, J. C.: On the Action of Beta and Gamma Rays of Radium on the Cell in Different States of Nuclear Division. *Arch. Middlesex Hosp.*, 12, 98-119, 1913.
- (12) SCOTT, C. M.: The Biological Action of Homogeneous and Heterogeneous X-rays. *Proc. Roy. Soc., London*, 112, 365-383, Feb. 1, 1933.
- (13) IDEM: Action of X-rays on the Eggs of *Calliphora*. *Proc. Roy. Soc., London*, 115, 100-121, 1934.
- (14) SUGIURA, K.: Studies on Radiosensitivity of Mouse Sarcoma 180 Irradiated *in vivo* and *in vitro*. *RADIOLOGY*, 29, 352-361, September, 1937.

SHADOW OF THE CARDIAC END OF THE STOMACH SIMULATING A SOFT TISSUE TUMEFAC-TION IN THE SUPINE POSITION

By LOUIS NATHANSON, M.D., M.Sc. (Med.), *Brooklyn, New York*

THE fundus of the stomach frequently casts an unusual shadow resembling a soft tissue tumor, when visualized in the supine position. The shadow appears as a dense ovoid, or well-rounded tumefac-tion, lying beneath the cusp of the dia-phragm and adjacent to the eleventh and twelfth dorsal vertebræ. The configura-tion varies considerably with change in the level of the diaphragm and with alteration in the content of the fundus of the stom-ach.

Figures 1, 2, and 3 are studies of three individual patients who showed this con-fusing shadow rather prominently. The finding was an incidental one in all three patients, in whom the examination was made for other purposes, namely, the uri-nary tract, lower costal structures, and the gastro-intestinal tract. In a fourth pa-tient (Fig. 4), the gas-filled cardia was

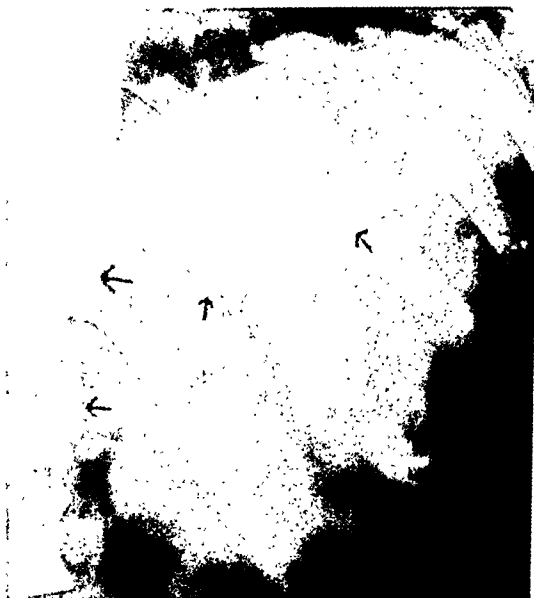


Fig. 1. Ovoid shadow of the fundus of the stomach in the supine position. Note the crus of the diaphragm passing downward to its insertion.

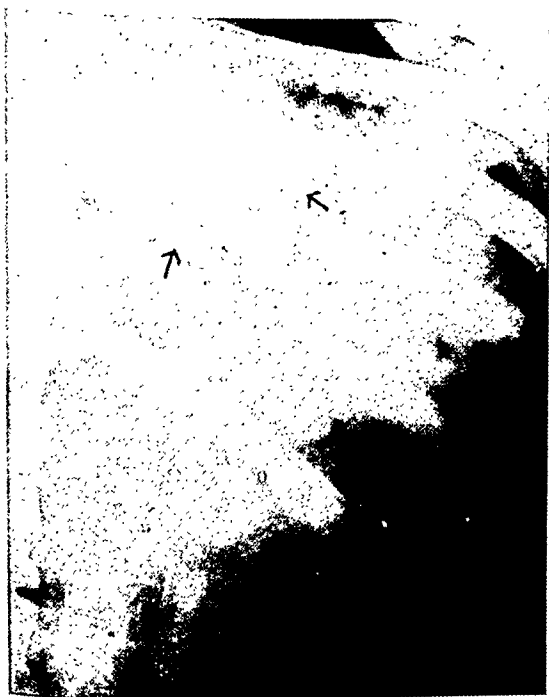


Fig. 2.

Fig. 2. Rounded circumscribed shadow of the fundus of the stomach. Study made primarily for the costal structures in the supine position.



Fig. 3.

Fig. 3. Similar rounded shadow to that shown in Figure 2. Note also the crus of the diaphragm. Supine position.



Fig. 4.



Fig. 5.

Fig. 4. Fundus partially filled with gas. Study in the prone position.

Fig. 5. Same patient as shown in Figure 4. Study made in the supine position. Note the soft tissue shadow which corresponds to the air-filled fundus in Figure 4.



Fig. 6.



Fig. 7.

Fig. 6. Fundus filled with barium. Study made in supine position. The outline of the barium corresponds in every respect to outline in Figure 5.

Fig. 7. Fundus partially filled with gas.

visualized in the prone position, and when studied in the supine position (Fig. 5) the cardia revealed itself as a similar solid shadow, as noted in Figures 1, 2, and 3. In order to corroborate this finding, the cardia was filled with barium (Fig. 6). Subsequently, the area was outlined by gas (Fig. 7).

It has been my experience to see this shadow misinterpreted repeatedly, and, on occasions, a surgical procedure has been advised with a diagnosis ranging from a cyst of the kidney, a fibroma, a subdiaphragmatic collection, an adrenal tumor, etc. Others have considered this shadow a normal finding and have interpreted it variously as a leaflet of the diaphragm, the left lobe of the liver, and as other soft tissue structures in this region. For a time,

it was my impression that the shadow was caused by the left leaflet of the central tendon of the diaphragm, and particularly so since the left crus of the diaphragm could be followed from the upper mesial margin of the shadow downward, and inward, parallel to the adjacent vertebræ, to its insertion into the second lumbar vertebra (Figs. 1 to 3).

The necessity for recognizing the nature of this shadow as a normal anatomical finding, rather than as a pathologic entity, is obvious. I have been unable to find a reference to it in the literature and, although it may be a well-known entity to some, it apparently is confusing to many of us, and undoubtedly is being misinterpreted constantly.

700 Ocean Avenue

CASE REPORTS AND NEW DEVICES

A CONVENIENT LANTERN-SLIDE EXHIBITION RACK

By VOIGT MOONEY, M.D., *Pittsburgh, Pennsylvania*

Figures 1, 2, and 3 show a lantern-slide exhibition rack, on which a large series of slides may be displayed at one time.

The rack is made from 28-gauge galvanized

zontal rods for the sides are milled from aluminum rods $\frac{1}{2}$ by $\frac{3}{8}$ inch thick and are attached to the upper angle irons. The first and last aluminum rods are milled on one side only. The standard size slides (4 by $3\frac{1}{4}$ inches) are slid into place through the grooves, where they are held firm by a notched aluminum lock strip. The reflected light is furnished by four 30-watt bulbs under the glass and fixed on the sides of

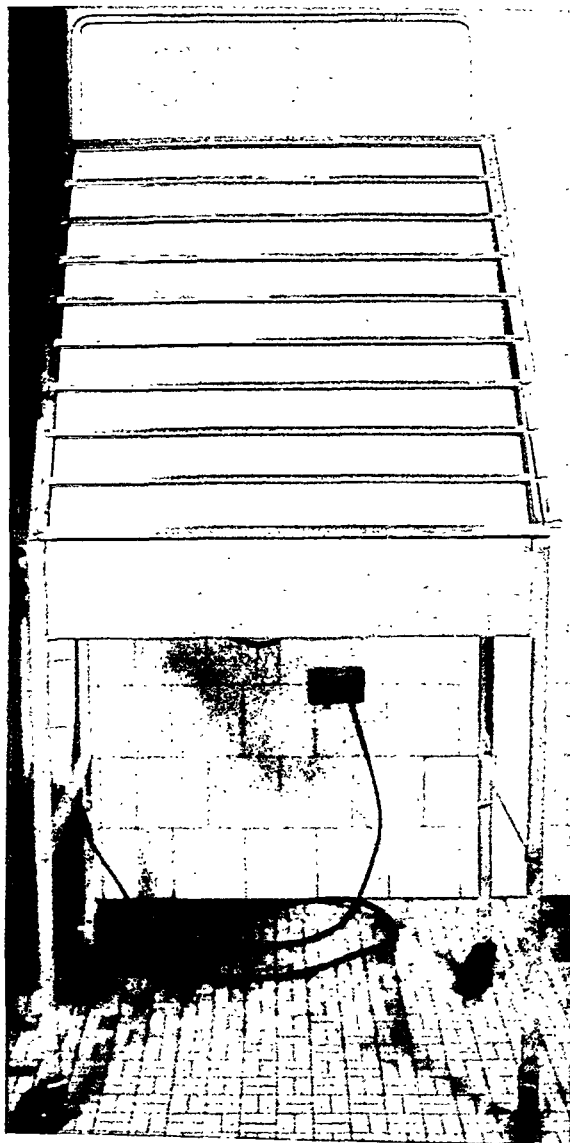


Fig. 1. Rack empty, front view.

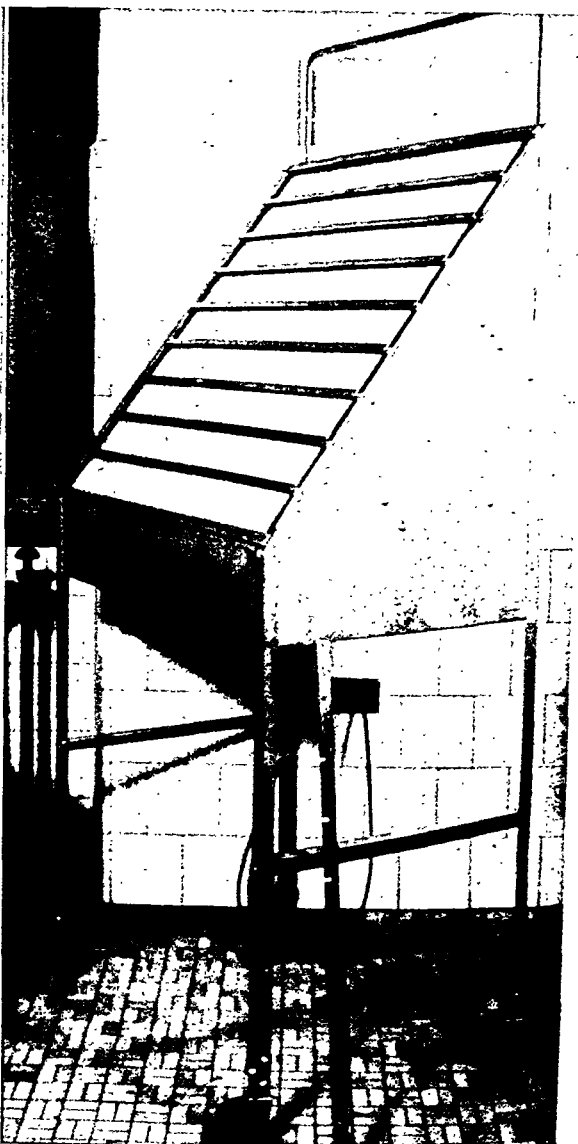


Fig. 2. Rack empty, side view.

iron and 1-inch angle iron. The glass used is flashed opal on one side. The H-shaped hori-

the frame. A concave metal reflector, painted white, is attached to the sides of the frame.

This metal-sheeting reflector starts at the top of the frame, in the back, follows the angle iron 10 inches, curves to a maximum depth of 12 inches, then up to the lower portion of the reviewing stage. The upper portion of the reflector, in the back, is perforated so as to allow the escape of the heat from the bulbs.

This rack holds 63 lantern slides and one can study the illustrations with much ease. Castors are attached to the legs, making the rack mobile. On the top of the rack there is a perforated aluminum support to which descriptive

A CEILING-MOUNTED TUBE RAIL FOR THE GENERAL DIAGNOSTIC X-RAY LABORATORY

By CLARENCE J. ZINTHEO, JR., B.Sc., Firland Sanatorium, *Richmond Highlands, Washington*

A convenient, and therefore frequent, arrangement of the equipment for a general roentgenographic laboratory places the stereo shifter or cassette holder for chest roentgenography at one end of the radiographic table.



Fig. 3. Rack filled, front view.

cards may be attached. The dimensions of the rack are $6.5 \times 30.5 \times 20.5$ inches.

500 Penn Avenue.

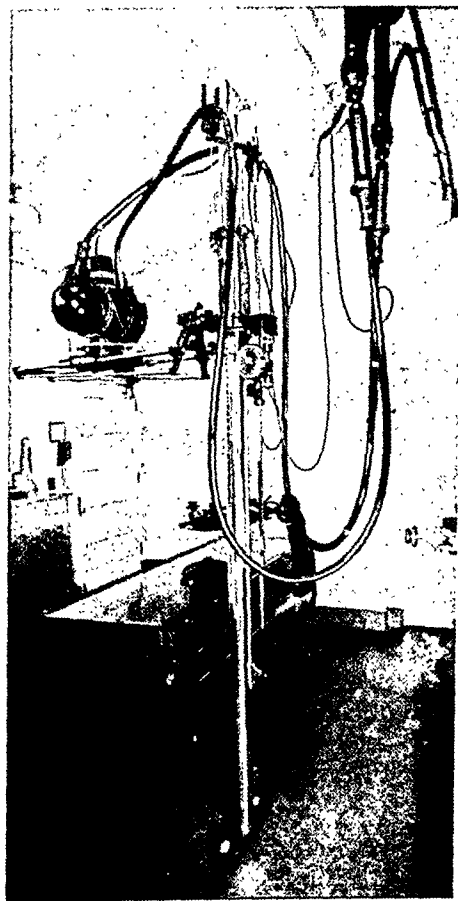


Fig. 1.

With such an installation increased flexibility in its use may be realized by extending the tube rails up to the vertical cassette holder so that the tube can be run far enough away to permit tilting the table to the vertical and using the table-mounted Bucky for upright exposures of all types. In some laboratories, however, the room arrangement requires free passage across the space between the end of the table and the vertical cassette holder which would be prevented by extension of the customary floor-

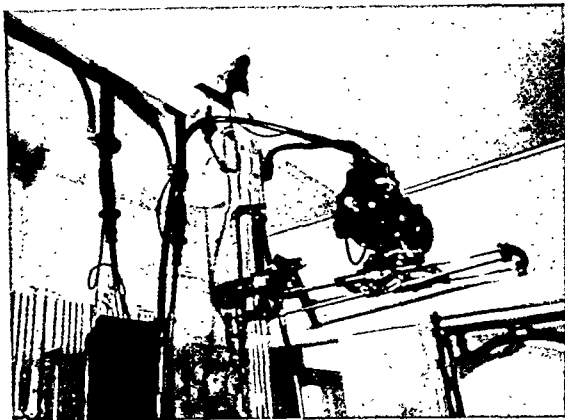


Fig. 2.

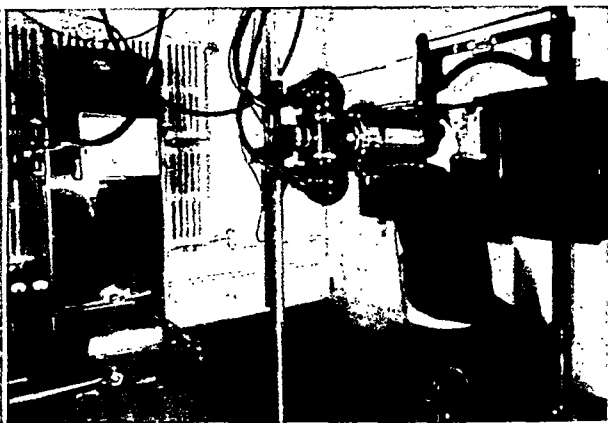


Fig. 3.

mounted tube rails. It has been found possible to solve the problem in such cases by mounting the tube rails on the ceiling. An added advantage accruing to the use of a ceiling-mounted installation lies in the possibility of obtaining five-foot exposures of a patient in a regular hospital bed, the latter being of special value in chest roentgenography of patients too ill to be moved.

Ceiling-mounted tube rails are not new, Fray (1) having described such a system some time ago. The unique points of the installation to be described here, lie in the adaptation of a standard tube column and rail truck to a ceiling-mounted rail, and the addition of a method of stabilization at the bottom of the column.

A special channel iron was fabricated, having mounted at its lower edge a two-inch round steel rail of the same diameter as the main rail of the replaced floor-mounted system. It was found that the regular tube column truck could be reversed and suspended from this rail without modification. The channel iron was at-

tached to the ceiling with one-half inch bolts, and side braces were used to take up the lateral strain. An extra long tube column which reached from the truck at the ceiling to the floor was used. A small, specially constructed floor truck having in tandem two wheels with one-quarter inch side flanges was connected to the base of the tube column by means of an internal spring of about fifty pounds' pressure. A strip of linoleum was cut out of the floor to make room for a flat steel rail of the same thickness as the original linoleum. Space between the sides of the rail and the cut edges of the linoleum provided room for the flanges of the wheels of the floor truck, thus preventing the slightest side motion. The general arrangement of the tube column with its floor truck and rail, and the ceiling-mounted rail with its braces is shown in Figure 1, and a view of the regular truck adapted to the ceiling-mounted rail is shown in Figure 2.

This floor truck is of value partly because it gives remarkable stability to the arrangement

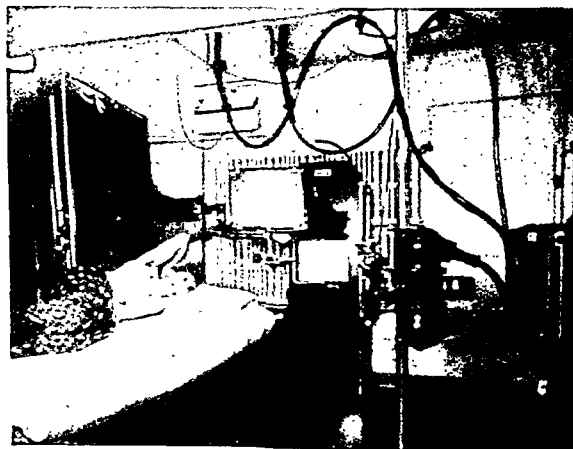


Fig. 4.

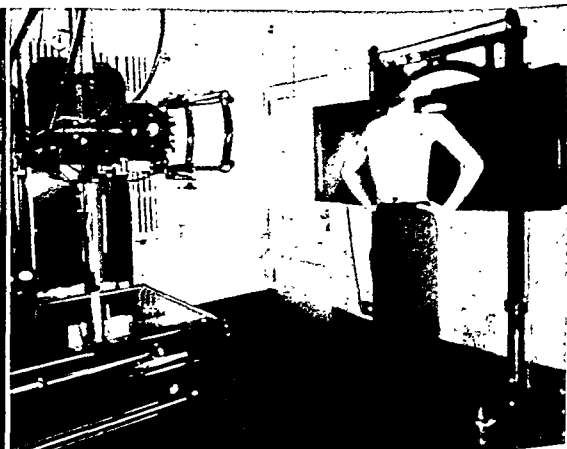


Fig. 5.

and partly because it permits the use of standard parts for the ceiling suspension and so makes for economy. The ceiling suspension takes about three-fourths of the load, the rest falling on the floor truck through its compression spring. With the main rail on the ceiling and only a flat bar on the floor which does not project above the level of the linoleum covering, there is perfectly free access across the space between the end of the table and the vertical cassette holder, in spite of the extended range. The space between the sides of the floor rail and the adjacent linoleum is only about one-quarter inch and it has been found unnecessary to protect the cut edge of the linoleum, there having been no cracking or breaking in over a year of hard usage.

Some of the special techniques made possible with the ceiling-mounted arrangement are illustrated in Figures 3, 4, 5, and 6. The tube, for instance, may be run across to the vertical cassette holder for sinus radiography in the upright position (Fig. 3). Distances up to six feet to the Bucky, when the table is tilted in the vertical position, are readily obtained, allowing chest Bucky exposures, which are especially valuable in patients having dense lesions or visceroptosis of the stomach, the colon, the gall bladder, and the kidney, and spine radiographs with the patient standing are as simple as with the patient lying on a horizontal table. It has also been found easy to obtain exposures of the chest in the lateral decubitus, using the Bucky and with the patient on a hospital stretcher as shown in Figure 4, a position which ordinarily is quite difficult. Figure 5 illustrates the standard positioning for chest roentgenography and shows the freedom of access across the space between the end of the table and the vertical cassette holder made possible with the ceiling suspension. When the table is tilted vertically there is ample room for a full size hospital bed to be run between the table and the vertical cassette holder, and with the tube extended to full height a five-foot chest exposure can be made without disturbing the patient (Fig. 6).

The increased flexibility of general radiography and the new positions and studies made possible have more than justified the expense of modifying the tube rail installation to the ceiling suspension.

REFERENCE

- (1) FRAY, WALTER W.: Teleoradiographic Unit Employing a Single X-ray Tube for Both the Ambulatory and Bed Patient. *RADIOLOGY*, 25, 356-359, September, 1935.

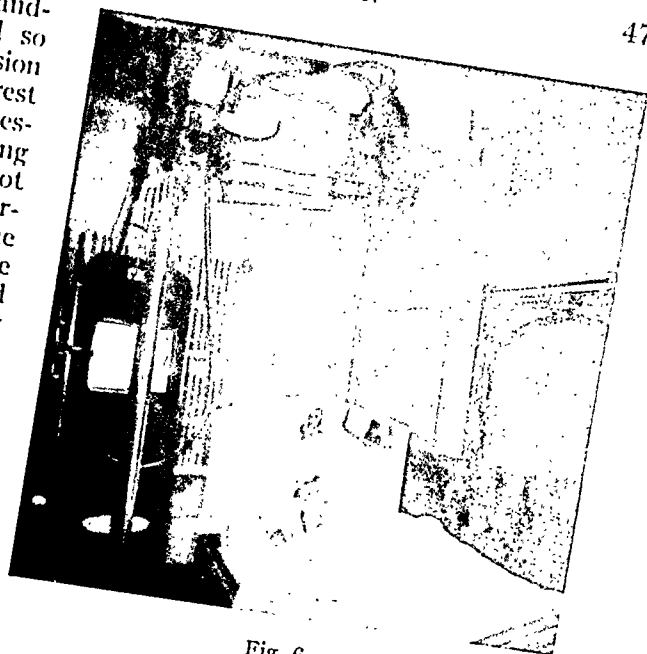


Fig. 6.

LARGE PEDUNCULATED LIPOMA OF COLON NINE YEARS AFTER RESECTION OF CARCINOMA OF COLON

By ORMAND C. JULIAN, M.D., *Chicago*

From the Department of Surgery and the Division of Roentgenology of the Department of Medicine of the University of Chicago

Submucous lipomas form a fairly large percentage of benign tumors of the gastrointestinal tract, especially of the colon. Pemberton and McCormack (1) reviewed the literature, collecting 113 cases, of which there were 94 with symptoms referable to the neoplasm. Pain was present in 75 cases, constipation in 49, blood with the stool in 27. In 64 cases it was possible to palpate a tumor mass. The average duration of the symptoms was 41.5+ months. These authors believe the diagnosis is not often made pre-operatively and that the most common errors are the diagnosis of carcinoma and appendicitis.

Fetzer (2) reported the case of a man, aged 65, who had a history of abdominal cramps and constipation, intermittently for seven years. Early in the course, these occurred at intervals of from four to seven weeks, but later became more frequent. The roentgenogram of the barium-filled colon showed a filling defect in the splenic flexure having a "malignant appearance." However, the length of the history and the pliability of the region at fluoroscopy gave rise to a diagnosis of a benign lesion. At

operation, a large submucous lipoma was found at the splenic flexure.

The following case is reported because it is

was felt that satisfactory bowel movements were not obtained without strong catharsis. With this previous history and return of symp-

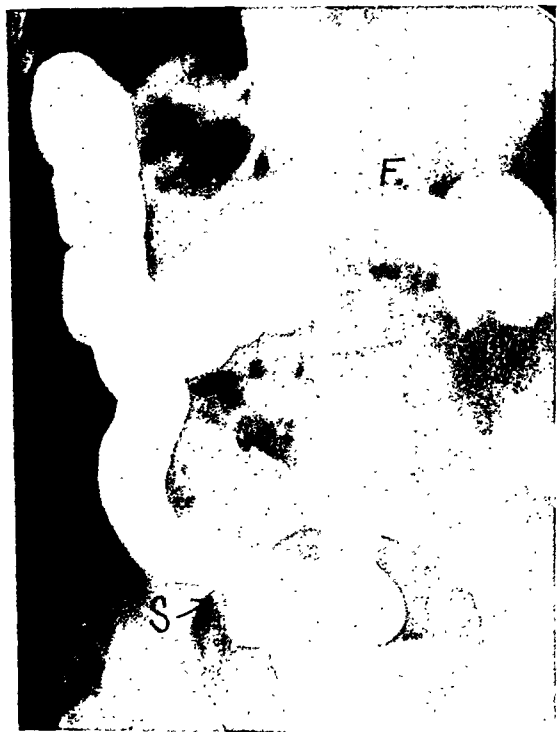


Fig. 1. Roentgenogram of barium enema showing S, site of excision of carcinoma of sigmoid seven years previously, and F, filling defect due to large submucous lipoma of right transverse colon.

an instance of development of first a malignant, and then a benign tumor of totally different cell type, in different parts of the colon, both producing serious symptoms.

A. G., a 59-year-old housewife, was admitted to the University of Chicago Clinics, in October, 1937. Nine years before, in June, 1928, there had been periods of cramp-like pain in the lower abdomen, accompanied by severe constipation. Catharsis relieved each attack, producing passage of hard, formed stools. In November, 1929, the patient had repeated hemorrhages of bright red blood from the rectum, and an adenocarcinoma of the lower descending colon was resected according to the Mikulicz procedure. During the following seven years, the patient was symptom-free, having normal stools after repair of the colostomy.

In March, 1936, the patient again noted bright red blood in the stools, and three weeks before admission to this clinic she again began to suffer colicky pain in the lower abdomen. It



Fig. 2. Photograph of everted segment of transverse colon bearing large submucosal lipoma.

toms, the patient was examined for a recurrence of the carcinoma of the sigmoid colon. At fluoroscopy the colon was seen to fill promptly with a smooth constriction at the site of the previous operation. Just distal to the hepatic flexure, there was a large smooth, rounded filling defect causing little apparent obstruction. The colon in this region and adjacent to the lesion was pliable and was traversed by peristaltic waves. No smaller polypi or diverticula were visualized in the remainder of the colon.

Laparotomy was done with the pre-operative diagnosis of tumor of the transverse colon, probably benign, but possibly malignant. Upon exposure of the transverse colon, a yellowish, soft mass was seen through the colon wall, within the lumen, and somewhat movable. It had the appearance of a typical lipoma. Palpation of the descending colon showed no recurrence at the previous site of the carcinoma, and a limited resection of the right transverse colon and tumor mass was carried out by the two-stage Mikulicz procedure.

Pathologic Study, Gross.—The specimen consists of a portion of bowel measuring 5.5 cm. in length, containing in its lumen a soft lobulated mass measuring $7.5 \times 4.5 \times 4$ cm. It

almost completely fills the lumen but is easily pushed aside, leaving adequate space for passage of bowel content, and is situated in the submucosa. Several large dilated veins are seen through the mucosal surface coursing over the tumor. The remainder of the bowel segment is normal.

Microscopic.—The section is through the fatty tumor and the overlying mucosa. The tumor tissue is composed of adult fat cells with a moderate amount of fibrous stroma. The mucosa is normal and not invaded by tumor cells.

Diagnosis.—Pedunculated submucous lipoma of the colon.

SUMMARY

A case is reported of large pedunculated lipoma of the right transverse colon producing symptoms seven years after successful resection of a carcinoma of the lower sigmoid portion.

REFERENCES

- (1) PEMBERTON, J., and McCORMACK, C. J.: Submucous Lipomas of Colon and Rectum. *Am. Jour. Surg.*, 37, 205-218, August, 1937.
- (2) FETZER, HANS: Lipoma of Colon: Roentgen Diagnosis. *Klin. Wchnschr.*, 16, 205-208, Feb. 6, 1937.

CARDIOSPASM

REPORT OF CASE

By MEYER GOLOB, M.D., Assistant Clinical Professor of Gastro-enterology, New York Medical College and Flower Hospital, New York City

The most interesting features of this case are those directing attention to the patient's psychology in relation to his physician and its frequently detrimental effect on indicated therapeutic measures. The physician who argues less, and does still less, save for drug therapy, is the one to whom the patient is more likely to adhere. It is not uncommon to find that a patient has persuaded himself that he is symptom-free, yet is subconsciously aware of a lesion lurking behind. What disturbs the writer is that this attitude may infect the clinician, who, although aware that he is involved in delaying indicated therapy, nevertheless yields to the patient's refractory mood and opposition to active measures, as long as death does not seem near. In this case the roentgen evidence stands in bold relief in Figures 1 and 2, with their respective dates, against a "100 per cent improvement," reported by both attending physician and patient.

For complete presentation of the case it is necessary to record the salient features. The patient, a female, 48 years of age, multipara,

presented a previous personal history significant only for constipation for the past 30 years. The presenting symptomatology was of two years' duration. Dysphagia, accentuated by solids and mitigated by swallows of water, dominated the clinical picture. This preference for liquids would suggest a neoplasm of the terminal esophagus. After about two and one-half years the situation reversed, as regards the physical state of food. Liquids made swallowing difficult and the enhanced dysphagia they caused at that time later suggested a spastic phenomenon.

For four months previously the patient had experienced nocturnal episodes of vomiting, not preceded by nausea. The vomitus consisted of a thick saliva accompanied by a sensation of burning in the upper esophagus (waterbrash). Some fluid was expelled through the nose. Her weight had fallen from 160 to 130 pounds (Nov. 25, 1936). Her appetite was capricious because of dysphagia, and asthenia persisted. Pyrosis of two years' duration was habitually eased by one-half a teaspoonful of sodium bicarbonate. The patient recited a classic picture of cholecystopathic dyspepsia with fat intolerance as a dominant feature. No symptoms referable to the cardiovascular, renal, pulmonary, or endocrine systems were elicited. Physical findings were essentially negative, except for weight loss.

Laboratory Summary.—Blood sedimentation rate, 22 mm. in 60 minutes; icteric index, 3 units; hemoglobin, 69 per cent (Nov. 25, 1936); white blood corpuscles, 7,800; red blood corpuscles, 3,620,000; differential, normal; feces negative for occult blood; gastric analysis, free HCl, 13; total acidity, 32.

DISCUSSION

The conditions to be considered for differential diagnosis were: (1) Cardiospasm; (2) Gall-bladder disease with cardiospasm as a reflex symptom, and (3) Carcinoma of the cardiac third of the stomach with associated spasticity of the terminal esophagus. A Plummer-Vinson syndrome was suggested because of the age of the patient, but the accepted criteria for such diagnosis were entirely lacking.

The patient's personality, not that of emotional instability, with no stigmata of neuroticism, opposed the consideration of entirely neurogenic etiology. Dyspepsia descriptive of biliary disease, as here obtained, co-ordinates with cardiospasm, the former as the basic etiology, the latter as superstructure. It is current knowledge that chronicity in disease is often attended with a slumbering phase in symptomatology, and when symptoms do

occur they all too frequently point away from the site of pathology. It is not unlikely that the physician in attendance had interpreted

what is pertinent in order to obtain adequate therapy is to detect the exact character of the lesion. As a matter of fact, carcinoma cardia



Fig. 1. Film made Dec. 31, 1936, 36 days following the first observation.



Fig. 2. Film made Dec. 21, 1937.

the intermittency phase of gall-bladder disease that paralleled a lull in symptoms at the terminal esophagus as one of cure rather than dormancy, although it was only to recur *para passu*, with gall-bladder activity. The marked hypochlorhydria would also support the diagnosis of gall-bladder dyspepsia. Cholecystography revealed a normal sequence, but cholesterosis (strawberry gall bladder) does not interfere with concentration or emptying. The viscus, therefore, may remain indicted.

Although the history at the time of presentation was of two years' duration, a recent and persistent symptomatology would be suggestive of a degenerative process. Thus, the symptoms of dysphagia and obstruction, and common sense application of the "law of probabilities," regarding the relative frequency of this condition as compared with others likely to be met with in persons of the usual cancer age, caused malignancy still to be entertained as a possibility, in spite of roentgen evidence favoring a spastic phenomenon. The question was whether or not the condition was one involving both esophagus and cardia. Where was its primary origin? It is not particularly essential to determine the primary of a lesion that involves both the end of the esophagus and the beginning of the stomach;

may begin in the upper end of the stomach or in the lower part of the esophagus. If the lesion has its incipency in the first locus, there may be a period of digestive disturbance, as is noted in the usual case of gastric carcinoma preceding dysphagia. On the other hand, if the lesion primarily implicates the terminal esophagus, dysphagia becomes a dominant symptom early in the disease. The relatively long duration would be in keeping with both a scirrhus type of carcinoma and cardiospasm, for in both of these conditions the symptomatology may have a lengthy history. The similarity of the duration might lead to a diagnosis of the lesser evil—cardiospasm. A scirrhus type of lesion might reveal roentgenologic evidence of a smooth stenotic process at the cardia, resembling the obstruction seen in cardiospasm and adding to the confusion. Thus, a scirrhus neoplasm would not only have a long-continued dysphagia, but a confusing anatomic picture, roentgenologically detected. The converse would be true in case of an ulcerating carcinoma at the cardia; the dysphagia would be of short duration and roentgenologically an irregular obstruction would be found. However, the difficulty in swallowing, in the case under discussion, varied in intensity unlike

the progressive course of this symptom in carcinoma.

Esophagoscopy was resorted to, keeping in mind that in carcinoma a lesion can be demonstrated, but not in cardiospasm, while in a scirrhus type of carcinoma a lesion may not be evidenced. The following are the results (Metropolitan Hospital, Welfare Island, New York): Dilated esophagus, markedly spastic, especially in its middle third, so much so as to render passage of scope difficult; the posterior esophageal wall thickened throughout its extent; spasm of cardia prevented entrance into the stomach. Specimen taken: microscopic appearance, hyperplasia of flat epithelium; no evidence of malignancy. In some areas epithelium showed interruption with evidence of polynuclear leukocytes. Diagnosis: Chronic catarrhal esophagitis.

A short follow-up summarizes activity alternating with freedom from symptoms. Thus the patient recited nocturnal episodes of vomiting, with some fluid escaping through the nose. Of passing interest was the fact that a normal bowel function paralleled absence of dysphagia; the converse also occurred. The dysphagia was dominantly intermittent, not only in intervals of days, but within the same day. Thus, swallowing was difficult at breakfast and normal at the evening meal and *vice versa*. In view of the fact that on one occasion a large stomach tube (28 French) was inserted, meeting no resistance, and removed and introduced with ease under the fluoroscopic screen, the Hurst method of mercury (flexible rubber tubes filled with mercury, sufficiently heavy to find their own way without being pushed) was advised, but refused by the patient.

On inquiry, a year later, the patient wrote, "gained ten pounds, improved 100 per cent." The attending physician confirmed the statement. The patient, on request, came for a check-up, and complained definitely of difficulty in swallowing. Her weight record showed 160 pounds a year previous to her first examination, 130 pounds on Nov. 25, 1936, and 127 pounds on Dec. 21, 1937. Under fluoroscopic screen study it was noted that as the column of barium was raised so as to nearly fill the entire esophagus, the opaque medium was seen to descend into the stomach. When the column of barium decreased in height, it was not seen to enter the stomach. The higher the column of food in the esophagus, the more likely was its ingress into the stomach. This may account for the fact that the clinical picture was not sufficiently alarming, and had lulled both patient and physician into a sense of pseudosecurity.

In conclusion, I believe the case merits

report more from a psychological than from a scientific angle. Teamwork and coördination in medical practice between clinicians would do much toward preventing maladies, initially characterized by a functional aberration, from degenerating into a basic, and, at times, a non-reversible stage of disease.

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ADOLESCENT TIBIA VARA

By JOHN A. SIEGLING, M.D., and JAMES B. GILLESPIE, M.D., Urbana, Illinois
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In recent years voluminous literature has appeared in medical publications on osteochondritis of various epiphyses in the body. With careful search a report of abnormal development in almost every epiphysis will be found recorded. From time to time lesions in heretofore rarely recognized locations are described and among these is osteochondrosis deformans tibiae, or tibia vara, as suggested by Blount (1). Blount, in January, 1937, presented an excellent review of the previously described cases of tibia vara and added 13 new ones, making a total of 28 reported cases of this condition. It is not the purpose of this paper to reiterate the excellent description or discussion of Blount but, rather, to add one more case of the so-called adolescent type of tibia vara to the medical literature.

Case Report.—M. K., white, female, aged 10 years, was brought to the clinic on Jan. 20, 1939, because of bowing of the left leg and pain in the left knee. The father and mother were alive and well, as were two brothers and one sister. There was no history of tuberculosis. The patient had had none of the contagious diseases of childhood and her general health had been good. The developmental history was negative. In May, 1937, she had had an appendectomy performed elsewhere with vomiting. Seven days following the operation she developed phlebitis in the left leg and, subsequent to discharge from the hospital, was in bed one month at home. She was then permitted to be up and allowed to go back to school. About January, 1938, she first noted pain in the left knee and some bowing and deformity of the lower left leg. She continued in school but because of pain in the knee frequently missed days in school. Heat applications gave her relief. In December, 1938, a

knee cast was applied in another clinic; it was removed after a few weeks. Following the appendectomy, she gained considerable weight.

proximal tibial epiphyseal cartilage, medially. A slight degree of inward torsion of the tibia was present. The leg lengths were equal.

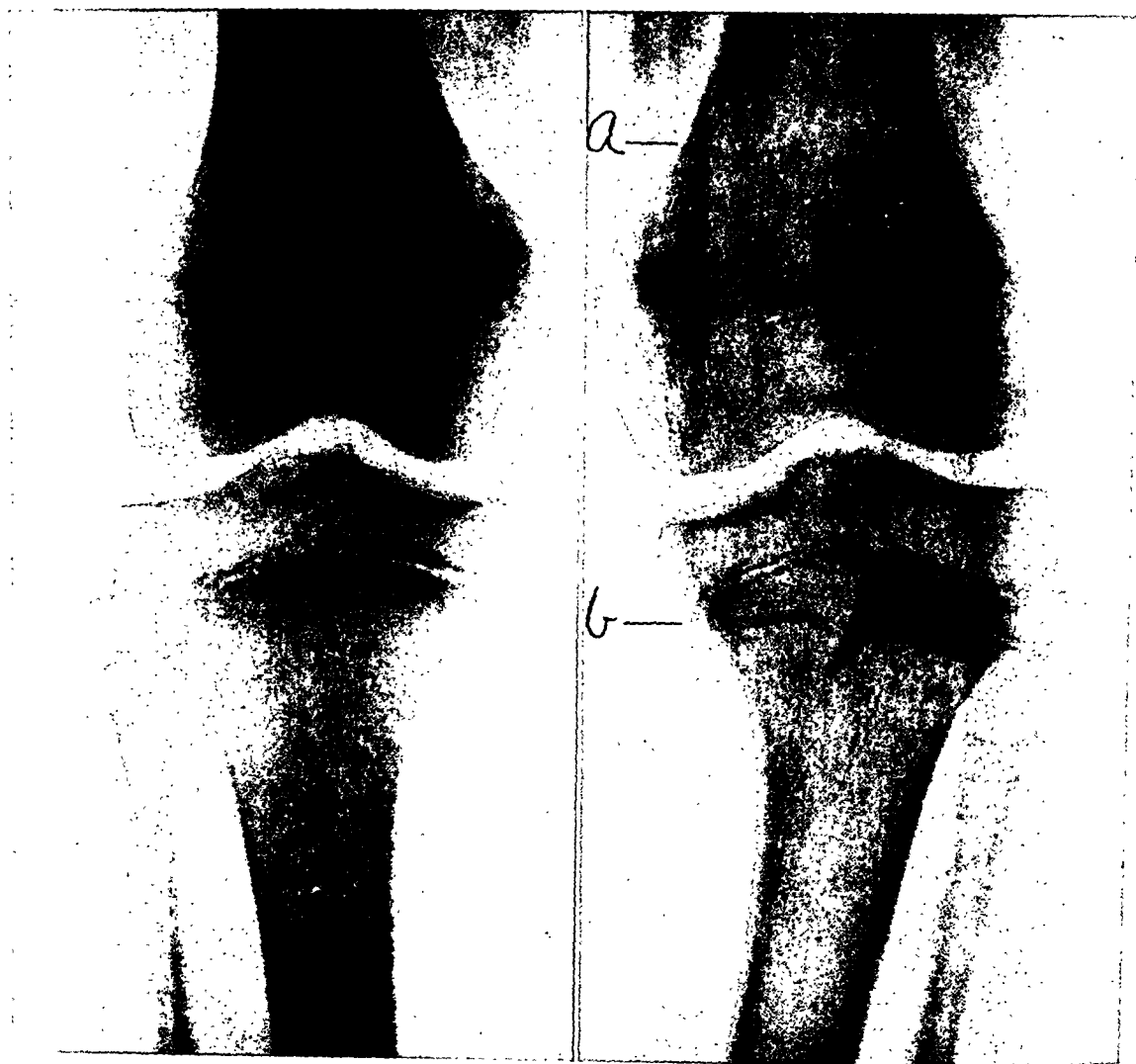


Fig. 1. Roentgenograms of both knees. Note the varus of the left tibia. (a) Growth arrest line; (b) Growth arrest line sloping toward the epiphysis.

The mother stated that bowing of the leg had become more marked in the last few months.

Examination showed the weight to be 85 pounds (38.6 kg.) and the height 52.75 inches (130 cm.). The normal average weight was 68 pounds (30.9 kg.). The adipose tissue was fairly well distributed. The tonsils were medium sized and infected. Some dental decay was present. The examination was otherwise negative except for the left leg. The left femur seemed straight but just below the left knee there was angulation of the tibia, giving the clinical appearance of genu varum. Slight tenderness was present in the region of the

The circumference at the calves of both legs showed the left leg to be one-half inch greater than the right.

Urinalysis was negative. The blood count showed the hemoglobin to be 87 per cent; erythrocytes, 4,410,000; leukocytes, 7,720; polymorphonuclear neutrophils, 38 per cent; lymphocytes, 48 per cent; monocytes, 2 per cent, and eosinophiles, 2 per cent. The basal metabolic rate was - 5 per cent. The blood calcium was 9.2 mg. and phosphorus 6.1 mg. The Mantoux test with 0.1 mg. of old tuberculin was negative, as was the Kahn test. Roentgenographic studies of the knees showed

the right knee to be essentially normal. The size and shape of the epiphyses conformed to her age. In the left knee the distal end of the femur was normal but acute angulation was noted medially in the subepiphyseal area of the proximal end of the tibia. The epiphyseal line sloped downward medially and there was a small beak-like projection at its medial end. Growth arrest lines were seen just proximal and distal to the epiphyseal lines in the femur and tibia, respectively. The growth arrest line was nearer the epiphyseal line on the medial side of the tibia than it was on the lateral side. Figure 1 shows roentgenograms of both knees. Growth arrest lines are not well reproduced. Figure 2 shows the patient at 10 years of age.

The case reported is of particular interest because growth arrest lines show that there has been retardation of growth at the medial side of the left proximal tibial epiphysis. It will be noted in the x-ray films that in the right knee the growth arrest line in the tibia is equidistant from the ends of the epiphyseal line. In the affected knee, however, the growth arrest line slopes to the medial end of the epiphyseal line, indicating diminished growth on that side.

There is no consensus of opinion as to a common etiological factor in osteochondritis. Two types have been described, the infantile and adolescent. The former is characterized essentially by faulty growth of the epiphyseal cartilage and delayed ossification of the medial portion of the proximal tibial epiphysis. The latter type is an arrest of epiphyseal growth rather than a dysplasia. In the case reported, it was not felt that the phlebitis played any part in its onset. Trauma, infection, embol-

ism, ischemia, and endocrine dysfunction have been suggested causes.

It has been established in Perthes' disease that interdiction of weight-bearing preserves the integrity of the capital femoral epiphysis and ameliorates symptoms. In this case in which the statics of weight-bearing was a definitely deforming factor, causing progressive genu varum, ambulation has been prohibited. Also a program of weight reduction has been instituted. The deformity will be followed radiographically. If no progression occurs, it is probable that there is insufficient deformity to warrant osteotomy for correction. If, however, deformity progresses, a proper time will be elected for surgical correction, realizing that recurrence of the condition is possible. It is conceivable that if early diagnosis is made in osteochondrosis deformans tibiae because of early pain, deformity may be minimized by early interdiction of weight-bearing.

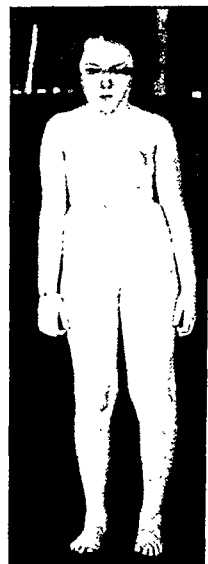


Fig. 2. The patient at the age of 10 years. Note the bowing of the left leg.

REFERENCE

- (1) BLOUNT, W. P.: Tibia Vara: Osteochondrosis Deformans Tibiæ. Jour. Bone and Joint Surg., 19, 1-29, January, 1937.

THE ECONOMIC STATUS OF THE RADIOLOGIST UNDER SOCIALIZED MEDICINE: A Report on England

Everyone who has studied socialized medicine knows the basic principle upon which the panel system operates. All physicians in England are affected in some manner by the present system whether they accept panel patients or not. It may be said that, although the British Medical Association, the Insurance Acts Committee, and the Local Panel Committee work together, the established fees, their allotment, and, in fact, the entire financial set-up is under the control of laymen.

The practice of radiology is affected in England in the same manner that it is in America by a large number of small machines in the offices of general practitioners without adequate training in film interpretation. The recognized radiologists practically all maintain offices for private practice. Many have hospital connections which are honorary appointments, and more than one radiologist may be appointed to a hospital staff.

Under the National Health Insurance Act in Great Britain medical benefit is limited to a general practitioner service defined as "all proper and necessary medical services other than these involving the application of special skill and experience of a degree or kind which general practitioners as a class cannot reasonably be expected to possess." Any specialist services required by an insured person must be the subject of arrangements outside the Act. The only exception to this is ophthalmic treatment. Some approved societies have surplus funds which they are allowed to spend on "additional benefits," one of which is Ophthalmic Benefit. In approved cases the society makes a grant toward the whole or part of the cost of an ophthalmic medical examination and sometimes toward the cost of ophthalmic treatment required. The number of such cases is relatively small.

The British Medical Association and the physicians in Great Britain regard the practice of radiology as a medical specialty and it is

recognized by the authorities under the National Health Insurance Act as not being a service to which insured persons are normally entitled gratuitously under the Act. There is excellent co-operation between the British Medical Association and the radiological societies and in its booklet, "Hospital Policy," the Association has set forth its policy in regard to the practice of radiology as it relates to hospitals, private patients, and those persons indemnified by some form of insurance.

In England the voluntary hospitals occupy about the same position in medical care as the private hospitals in this country. Omitting entirely anything pertaining to government hospitals, it may be said that the bulk of hospitalized patients are cared for in those institutions supported wholly by voluntary contributions. The contributory schemes, in which regular small contributions are received from persons of the National Health Insurance class, have some of the characteristics of hospital insurance plans. Some schemes have reciprocal arrangements whereby an individual may be hospitalized in a locality where he is not a contributor.

The National Health Insurance plan does not provide for hospitalization but the cash benefits do allow something for continuance of contributions. The contributions are not expected to pay in full for hospital care of the individual but to supplement other revenue received in a like manner. Solicitation of funds is made by volunteers and contributors are placed on a contributors' list.

The radiologists, the same as other specialists on the voluntary hospital staff, receive no remuneration for their services to the ordinary hospital class of patient. The equipment is owned and maintained by the hospitals, which purchase all films and supplies and furnish the technical help. If a fee is collected for radiological consultation, one-third of the amount goes to the hospital to defray its expenses incident to the examination, and two-thirds to the radiologist. The British Medical Association's view is that the radiological department

¹ Prepared at the request of the Inter-Society Committee by S. W. Donaldson, M.D., Ann Arbor, Michigan.

should not be managed in such a way as to make a profit for the hospital by the exploitation of the professional services of the visiting radiologist. The recommended method, although it cannot always be carried out, is that patients who are able to pay a fee be referred to the private office of the radiologist.

Patients who receive roentgen-ray service in the voluntary hospitals under the contributory scheme pay nothing, the same as they do for the services of other specialist members of the staff.

A modified fee list for x-ray examinations for persons who cannot pay ordinary fees has been compiled and approved by the radiological societies and made available to the medical profession and hospitals by the British Medical Association.

Proposals which have so far been made for an extension of medical benefit under the National Health Insurance Act to cover consultant and specialist services indicate that payment for radiological services would take the form of a flat rate (probably one guinea or approximately \$5.00 in United States money) for the diagnostic service, excluding the use of apparatus and materials incidental to the service.

As a whole, the practice of radiology in England consists of referred private patients who pay a private fee, charity patients and "contributing members" who are examined in the department of radiology in a voluntary

hospital, and referred patients who are indemnified by some form of insurance. For these, a fee is collected. In the tax-supported institutions, either full-time or part-time salaried physicians furnish radiological consultation.

Patients having sickness or accident insurance should, in theory, be referred to the private office of a roentgenologist, but this is not always the case. Industrial and automobile accident cases are taken directly to a hospital and there receive x-ray service either as a contributor, or an opinion from a staff member or an honorary roentgenologist without the insurance company paying a fee for such service.

The great increase in the number of persons participating in the contributory schemes tends to divert private practice to the hospitals. Also, the present trend is for a greater number of persons to come under some form of government insurance with a higher wage-earning bracket. These two factors affect the entire medical profession as well as the specialties. Among the specialties the fees allowed for insurance cases are at a reduced rate.

I wish to express my appreciation and thanks to the officials of the British Medical Association and to those radiologists in England who aided me in obtaining information to be included in this report.

S. W. DONALDSON, M.D.

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—*Chairman*, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; *Secretary*, Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—*President*, E. N. Liljedahl, M.D., 1322 North Vermont Ave., Los Angeles; *Vice-president*, M. L. Pindell, M.D., 670 South Ferris Ave.; *Secretary*, Wilbur Bailey, M.D., 2007 Wilshire Blvd.; *Treasurer*, Henry Snure, M.D., 1414 South Hope Street. Meets every second Wednesday of each month at County Society Building.

Pacific Roentgen Club.—*Chairman*, Lyell C. Kinney, M.D., San Diego; *Secretary*, L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—*Secretary*, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—*President*, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president*, K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary*, E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer*, H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—*Chairman*, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer*, Max Climan, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—*President*, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa;

Vice-president, H. B. McEuen, M.D., 126 W. Adams St., Jacksonville; *Secretary-Treasurer*, J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—*President*, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president*, William F. Lake, M.D., Medical Arts Bldg., Atlanta; *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—*President*, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president*, Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer*, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—*President*, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president*, Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer*, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, *Chairman*, and Warren W. Furey, M.D., 6844 Oglesby Ave., Chicago, *Secretary*.

INDIANA

Indiana Roentgen Society.—*President*, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect*, Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president*, A. C. Holley, M.D., Attica; *Secretary-Treasurer*, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—*Chairman*, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary*, Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—*President*, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor;

Vice-president, Clarence Hufford, M.D., 421 Michigan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—*President*, E. R. Witwer, M.D., Harper Hospital, Detroit; *Vice-president*, D. W. Patterson, M.D., 622 Huron Street, Port Huron; *Secretary-Treasurer*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—*President*, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; *Vice-president*, Leo G. Rigler, M.D., University Hospitals, Minneapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—*President*, L. G. Allen, M.D., 907 N. 7th St. Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—*President*, Paul C. Schnobelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—*President*, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—*President*, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Ray Society.—*President*, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island

College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—*President*, Walter Mattick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—*President*, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—*President*, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—*President*, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—*Chairman*, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Associated Radiologists of New York, Inc.—*President*, Albert L. Voltz, M.D., 115-120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. J. Francis, M.D., 121 Madison Ave., New York City; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—*President*, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—President, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; Vice-president, R. V. May, M.D., St. Luke's Hospital, Cleveland; Secretary-Treasurer, Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—President, B. M. Warne, M.D., Doctors Building, Cincinnati; Secretary-Treasurer, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—President, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; First Vice-president, Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; Second Vice-president, Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; Secretary-Treasurer, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; President-elect, Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; Editor, William E. Reiley, M.D., Clearfield. Annual meeting, May, 1939. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—President, Thomas P. Laughery, M.D., Germantown Hospital; Vice-president, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; Secretary, Barton H. Young, M.D., Temple University Hospital; Treasurer, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—President, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; Secretary, Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—President, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; Secretary-Treasurer, Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—President, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; Vice-president, Steve W. Coley, M.D., Methodist Hospital, Memphis; Secretary-Treasurer, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—President, Jerome H. Smith, M.D., San Antonio; President-elect, C. F. Crain, M.D., Corpus Christi; First Vice-president, M. H. Glover, M.D., Wichita Falls; Second Vice-president, G. D. Carlson, M.D., Dallas; Secretary-Treasurer, Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—President, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; Vice-president, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; Secretary, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—President, H. E. Nichols, M.D., Stimson Bldg., Seattle; Secretary, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—President, H. W. Hefke, M.D.; Vice-president, Frederick C. Christensen, M.D.; Secretary-Treasurer, Irving I. Cowan, M.D., Mount Sinai Hospital, Milwaukee. Meets monthly on first Friday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

THE LYMPHATICS

It would seem that more attention should be given to the study of the lymphatic system since it is so closely associated with the cancer problem. The importance of this knowledge is especially valuable to the radiologists who are constantly treating malignancies. They should be thoroughly acquainted with the lymphatic distribution between the organ or organs affected and the first lymph station, since they must apply their therapy over these areas if they hope to stop the spread of cancer cells. In other words, the lymphatic route which disseminates cancer cells is to be considered of great importance.

This system plays an important part in the domain of physiology and particularly in that of pathology. Among the many functions attributable to the lymphatics are those of nutrition, of defense of the organisms against toxic elements, infectious diseases, and neoplastic elements.

Our present knowledge of the primary development of the mode of growth of the lymphatic system dates back to 1902, when Florence Sabin first clearly showed its mode of origin and growth.

There are some who believe that cancer cells gain entrance and spread through the lymphatic vessels to the lymph nodes in a manner similar to any other foreign material such as carbon, thorium dioxide, etc. It may, therefore, be of some interest to present certain experimental works done in this regard. As far back as 1875, Loughans injected certain lymphatics in breast cancer to ascertain the lymphatic spread, and concluded that the perivascular lymphatics may in certain cases be filled with cancer cells. Outstanding among a large number of investigators studying the route of absorption of particulate matters by the lymphatic system is the work of Herring and MacNaughton (1). By injecting insoluble materials, such as carbon and carmine,

into the subcutaneous tissues of the legs of animals and recovering the substance in the lymph nodes, these two workers have been able to prove that the lymphatic system absorbs these substances. They concluded that many of these solid particles are taken up in the cytoplasm cells, which pass through the walls of the lymphatics by diapedesis into the lymphatic system. Their contention is: The phagocytic cells are arrested in the first lymph gland on the lymph stream, and the cells carrying solid particles pass from the lymph sinuses of the gland into the lymph tissue of the cortex and medulla of the gland, and eventually discharge their burden among the lymphocytes in these situations. Solid particles and even red corpuscles, arriving at the gland in the lymph stream in a free state, are dealt with by the endothelial cells of the reticulum of the lymph tissues. These cells, analogous to the Kupffer's cells of the liver sinusoids, ingest material, detach themselves, and carry into the lymphoid tissue of the gland in exactly the same way.

This is the explanation of the mode of absorption by the lymphatic system, when carbon, carmine, and thorium dioxide are used for injection, and may explain the manner in which cancer cells are taken up and distributed by the lymphatic system.

While we know that cancer cells may travel through the lymphatic vessels, we have been uncertain regarding the actual rate of flow, whether the flow is a continuous or an interrupted one, and the pressure of lymph in lymph vessels. This question still remains one to be studied. While it is true that many investigators agree that the flow is continuous in all lymphatics, there are some who do not subscribe to this thought. There are others who believe that lymphatic embolism is comparatively rare since such emboli are not often seen in microscopic sections. Others claim that

fundamental basis of correct interpretation, and he emphasized this principle throughout his life. He remained meticulous to a fault.



The late LEOPOLD JACHES, M.D.

He developed also a healthy respect for the potential dangers of x-ray radiation.

On July 1, 1908, he became chief of the Roentgen Department of the Mount Sinai Hospital, New York, succeeding the late Dr. Walter Brickner. Concerning the department, Dr. Jaches once wrote as follows: "From small beginnings, this department developed during the succeeding years into a large diagnostic and therapeutic institute through the aid of the Board of Trustees, and the particular personal interest of the late Mr. Jacob Emsheimer, and the more recently deceased Mr. Ernest Rosenfeld. In this connection, I must not fail to mention the sympathetic co-operation of Dr. Joseph Turner, Director of the Mount Sinai Hospital."

Early in 1917, Dr. Jaches was made a Captain in the Medical Corps of the U. S. Army, and in July, 1917, was ordered for service at the New York School of Military Roentgenology, where he subsequently became an instructor. The material used for the course of instruction remains collected in an

unpublished volume. It reveals vividly the personality of the one who had so much to do with its execution. Even at this relatively early day, careful attention to detail is found, side by side with completeness.

In 1918, being promoted to Major, he was sent to France in charge of a group of x-ray mechanics and technicians described as Roentgen Unit No. 1. Later he became assistant to Col. Arthur C. Christie, M.C., who was Senior Consultant in Roentgenology. In 1919, when Dr. Christie was ordered home, Dr. Jaches was appointed his successor and was promoted to Lt. Colonel. He shared offices with one whom he held in high esteem, the late Lt. Colonel John S. Shearer, Technical Consultant in Roentgenology. This was a busy time. Hospitals were being closed, x-ray equipment had to be disposed of, and personnel shifted or returned home. By June, 1919, his job was completed and he was ordered home.

From 1919, Dr. Jaches again devoted himself to private practice and to the development of the Department of Radiology at the Mount Sinai Hospital. He threw himself eagerly into any movement which had as its object the betterment of radiology. In 1908, he was elected to membership in the American Roentgen Ray Society which, in 1930, honored him by electing him its President. In 1923, he joined the Radiological Society of North America and, in 1933, became a Fellow of the American College of Radiology. In 1936, the American Roentgen Ray Society appointed him to the American Board of Radiology. In July, 1936, he was appointed Clinical Professor of Radiology at Columbia University. He was a charter member of the New York Roentgen Society and a Fellow of the New York Academy of Medicine. He was a Consultant Roentgenologist to Montefiore and Norwalk Hospitals.

The dynamics of this modest man cannot be expressed by the narration of events. Nor does the listing of his publications and honors give sufficient indication of his service to the art and science of radiology because, so often, he insisted on remaining in the background and letting the others do the writing and presenting. He was one of the first radiologists in New York to be interested in retrograde pyelography and retrograde cystography. The book on "Clinical Roentgenology of the Chest," by Wessler and Jaches, is still a standard text and for many years was the only satisfactory textbook in English. His more recent con-

tributions on pulmonary suppuration, osteolytic bone tumors, and the roentgen diagnosis of urinary diseases are too well-known to need special comment.

Internationally known, Dr. Jaches was a pioneer. He was welcomed to the deliberations of those who steer the course of radiology, often himself guiding, always self-effacing. His outstanding characteristic was his honesty and his intolerance of anything which smacked of dishonesty. It is said that he never spoke a mean word. Those who knew him realized that Dr. Jaches was kind, warm-hearted, and generous. To some, he may have appeared indifferent but this was but an attempt to disguise his inherent modesty. As a friend he was faithful; as a preceptor, he was inspiring; as an associate, he was loved and respected.

Dr. Jaches wrote, "My professional life has been satisfying in every way. My personal satisfaction in the work could not have been greater."

MARCY L. SUSSMAN, M.D.

CHARLES D. CLEGHORN, M.D.

Charles D. Cleghorn, M.D., 60 years old, prominent radiologist, died after a prolonged illness on March 25, 1938, in Miami, Florida. He was born in Madison, Wisconsin, June 24, 1878. He received his Bachelor of Science degree at Princeton University in 1900 and the degree of M.D. from Columbia University, College of Physicians and Surgeons, New York City, in 1904. He became interested in radiology as early as 1912, when he took up post-graduate studies with Dr. Charles Eastmond, of Brooklyn, and the study of radium therapy with Dr. George Stuart Willis, Post-graduate Medical School, New York.

From 1912 to 1915 Dr. Cleghorn was roentgenologist to the Nassau County Hospital, Mineola, New York, and to the Macon City Hospital, Macon, Georgia, from 1915 to 1924. He removed to Miami, Florida, in that year and became associated with the x-ray Department of the Jackson Memorial Hospital, and consultant in roentgenology to the Victoria and Riverside Hospitals.

By his personal charm, integrity, and calm manner Dr. Cleghorn had won the friendship and admiration of his colleagues. He was elected President of the Dade County Medical Society in 1929, and of the Staff of the Jackson

Memorial Hospital in 1931. He was a charter member of the Florida Radiological Society, also a member of the Radiological Society of



The late CHARLES D. CLEGHORN, M.D.

North America. In 1935 he was granted a diploma in radiology by the American Board of Radiology. He made numerous contributions to medical journals, both state and national, on radiological subjects.

Dr. Cleghorn is survived by his widow, Susan E. Cleghorn, two sons, Charles D., Jr., and John, and two daughters, Mrs. Fannette C. Lester and Lucy Ann Cleghorn.

Those of us who were fortunate to know him will cherish his memory as one of our most treasured recollections.

BOOKS RECEIVED

Books received are acknowledged under this heading, and such notice may be regarded as an acknowledgment of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

ROENTGEN DIAGNOSIS OF THE EXTREMITIES AND SPINE.
By A. B. FERGUSON, M.D., Director of Roentgenology, New York Orthopedic Hospital. *Annals of*

Roentgenology, Volume 17. A volume of 435 pages, with 512 illustrations. Published by Paul B. Hoeber, Inc., New York City, 1939. Price: \$12.00.

OH, DOCTOR! MY FEET! By DUDLEY J. MORTON, M.D., Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University. A volume of 116 pages. Published by D. Appleton-Century Co., New York City, 1939. Price: \$1.50.

LEUCHTSCHIRM PHOTOGRAPHIE RÖNTGENREIHENUNTERSUCHUNG (Photography of the Screen Image; A Method of Serial Roentgen Examination). By Prof. Dr. ROBERT JANKER, of Bonn. No. 69 of Tuberkulose-Bibliothek, edited by Dr. Franz Redeker and Dr. Karl Diehl. A monograph of 57 pages, with 58 illustrations. Published by Johann Ambrosius Barth, Leipzig, 1938. Price: 8 reichmarks.

BOOK REVIEWS

THE 1938 YEAR BOOK OF RADIOLOGY. *Diagnosis* edited by Charles A. Waters, M.D., Associate in Roentgenology, Johns Hopkins University; Assistant Visiting Roentgenologist, Johns Hopkins Hospital; Associate Editor, Whitmer B. Firor, M.D., Assistant in Roentgenology, Johns Hopkins University; Assistant in Roentgenology, Johns Hopkins Hospital; *Therapeutics* edited by Ira I. Kaplan, B.Sc., M.D., Director, Division of Cancer, Department of Hospitals, City of New York; Clinical Professor of Surgery, New York University Medical College; Director, Radiation Therapy Department, Bellevue Hospital, New York City; Director, New York City and Brooklyn Cancer Institutes; Associate Radiologist, Lenox Hill Hospital, New York City. A volume of 512 pages, with 511 illustrations. Published by The Year Book Publishers, Inc., Chicago, 1938. Price: \$4.50.

The 1938 Year Book of Radiology presents the same excellent review of the radiologic literature that the medical profession has found in previous volumes. The difficult job of reviewing a vast number of articles, of selecting only those most worthy of consideration, and of abstracting them has been handled with clarity and judgment. The editorial comment which follows selected abstracts is one of the most valuable features of the book.

As in previous years, the publisher is to be congratulated upon the excellence of the cuts reproduced from the articles reviewed. The fact that these cuts may precede or follow the abstract by a page or more is only a minor annoy-

ance, and one which may be eliminated in future books.

Titles in the section on diagnosis are grouped as follows: osseous system; skull, sinuses, and mastoids; soft tissues; glandular system; cardiovascular system; gastro-intestinal system; genito-urinary system; obstetrics and gynecology; nervous system; technic, and teaching and principles of practice. In the section on radiotherapeutics the following subdivisions are found: general considerations; biology; physics; radiation in general medicine, in ophthalmology, in dermatology, in otolaryngology, in chest conditions, in diseases of the breast, in gastro-intestinal conditions, in gynecology, in genito-urinary conditions, in diseases of bone; in radiation injuries. As in previous volumes, complete subject and author indices are appended, making the book one for ready reference.

As the editors state, there has been no sensational discovery nor any single work of outstanding importance during the past year. Instead, the articles reviewed show a steady growth in our ability to use roentgen rays in diagnosis and treatment. It is noteworthy that many refinements in diagnostic technic have been reported in the past year. One no longer can be satisfied with simple anteroposterior and lateral projections. An article of more than passing interest and enjoyment is that on the "Life of Wilhelm Conrad Roentgen as Revealed by His Letters," by Dr. Otto Glasser, which is reprinted almost in its entirety.

This reviewer unhesitatingly recommends the 1938 Year Book of Radiology to anyone interested in the use of roentgen rays, be he radiologist, surgeon, internist, or general practitioner.

ORTHOPEDIC APPLIANCES. The Principles and Practice of Brace Construction for the Use of Orthopedic Surgeons and Bracemakers. By HENRY H. JORDON, M.D. Foreword by E. G. BRACKETT, M.D., Editor of *The Journal of Bone and Joint Surgery*. A volume of 411 pages, with 176 illustrations. Published by Oxford University Press, New York, 1938. Price: \$4.00.

The use and manufacture of braces is a subject of importance to all physicians interested in orthopedic surgery. Braces are an important part of the equipment of any orthopedist in practice. Unfortunately much of the teaching of bracemaking and bracefitting is

handed down from bracer to bracer with the orthopedist having little in the way of actual opportunity to learn the more detailed part of the work. Textbooks afford but fragmentary information along this line. Numerous articles from time to time describe some piece of apparatus but to have this available at all times is very difficult. For this reason this volume on orthopedic appliances fills a definite need in the English literature. It is concisely

and clearly written, with good illustrations and a sufficient number of line drawings to make the volume a practical one.

For any one practising orthopedic surgery this book can be recommended. One may disagree with some of the author's recommendations regarding the type of brace to be selected or even with the method of construction and fitting, but on the whole it presents the subject in a very concise and useful form.

ABSTRACTS OF CURRENT LITERATURE

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ANIMAL EXPERIMENTATION

An Experimental Study on the Effect of the Change of Environments of Animal Cells on Their Radio-sensitivity. Y. Kagami. *Japanese Jour. Obst. and Gynec.*, 21, 284-288, July, 1938.

Unfertilized and fertilized eggs of the sea urchin were irradiated with from 100 r to 500 r of x-rays. In every instance it was found that normal mitosis and metamorphosis were inhibited and retarded, and the greater the dosage, the greater the retardation. The effect was greater in the fertilized eggs. No abnormal mitosis was noted.

When sea water only was irradiated and the non-fertilized and fertilized eggs were placed in it for a certain period, their subsequent process of mitosis was accelerated to some extent. The pH value of the sea water showed a tendency to decrease slightly in direct proportion to the amount of irradiation.

W. A. WARD, M.D.

Studies on Irradiation of the Reticulo-endothelial Tissue with Small Doses of Roentgen Rays. Sv. A. Chrom. *Acta Radiol.*, 18, 715-721, October, 1937.

The purpose of this study was to ascertain whether or not local or universal x-ray irradiations with doses ranging from 10 r to 75 r might be able to stimulate the phagocytic activity of the reticulo-endothelial system of mice. The local organ selected was the liver. The results were checked by counting the number of bacterial colonies of a Breslau 206 strain in cultures from heart blood from one to ten hours after intravenous production of bacteremia. Neither the local nor the universal irradiations produced any appreciable change in the normally observed phagocytosis.

ERNST A. SCHMIDT, M.D.

APPARATUS

Cold Screening in Low-power Radiography. S. T. Li. *Chinese Med. Jour.*, 54, 73-75, July, 1938.

The author discusses the difficulty of obtaining penetration with low-power x-ray machines. He describes a means of obtaining sufficient density with the slow type intensifying screens which give better details than the fast type. The author very simply increases the density of his plates 50 per cent by cooling down the temperature of the intensifying screen.

W. H. GILLENLINE, M.D.

Historadiography. P. Lamarque. *British Jour. Radiol.*, 11, 425-435, July, 1938.

Special apparatus must be used for historadiography as the rays used are too soft to penetrate the ordinary glass tubes. This apparatus is briefly described. A section of tissue no thicker than 4 microns is placed directly on the emulsion for radiography. Special emulsions must be used as the best on the market are too

coarse grained. The technic of mounting and making the radiograph is described briefly. The resulting radiogram is similar in appearance to a conventional section as seen through a microscope, but the differences are great enough to require some experience in proper interpretation. Several excellent reproductions are printed. This procedure opens possibilities of new fields of research, but more progress in the technical and interpretative aspects needs to be made.

S. J. HAWLEY, M.D.

The Geiger-Müller Counter: A Recent Instrument in Medicine and Medical Research. M. L. Weinstein and Leopold Rovner. *Jour. Lab. and Clin. Med.*, 24, 82-95, October, 1938.

The Geiger-Müller counter is a physical instrument for observing ionizing radiations of very low intensity. It has been used for detecting harmful stray radiations from x-ray and radium equipment, and it is the most practical device for finding lost radium.

It is predicted that such an instrument may have a future in radiobiology and in physiology by tracing foodstuffs in the metabolic process, or for observing the transfer of chemical substances during various physiologic activities.

The apparatus is extremely sensitive and will record the entry of a single electron or the absorption of a single photon (light corpuscle) within the limits of its sensitive chamber.

W. A. WARD, M.D.

The Technic of Neutron Production and the Production of Artificial Radio-activity. A. Bouwers. *Strahlentherapie*, 63, 537, 1938.

The author briefly describes various methods of producing neutrons: the cyclotron of Lawrence, the electrostatic generator of Van de Graaff, and the cascade generator.

ERNST A. POHLE, M.D., Ph.D.

THE APPENDIX

Chronic Appendicitis and X-ray Study. Heinz Lossen. *München. med. Wchnschr.*, 85, 1237, 1238, Aug. 12, 1938.

A brief discussion of the x-ray signs of chronic appendicitis. Pericecal masses, displacement of the appendiceal lumen, and non-filling of the appendix may be present. If a barium sulphate-magnesium sulphate mixture is given, sometimes excessive motility of the bowel is noted.

LEWIS G. JACOBS, M.D.

Lipiodol in the Treatment of Persistent Fecal Fistula after Appendectomy. S. N. Mendelsohn and L. H. Schriver. *Surg.*, 4, 430-433, September, 1938.

The authors point out that treatment of post-appendiceal fistula by operation is often hazardous,

while conservative treatment usually fails. Sometimes the patient's condition is such that operation is dangerous or the patient refuses to submit to another operation.

Two cases are reported in which the fistulas healed very promptly after the introduction of iodized oil with intent to examine the extent, course, and character of the fistulous tract. In both cases healing occurred within from seven to ten days.

JOHN E. WHITELEATHER, M.D.

Calcified Fecalith in the Appendix: Report of a Case of Acute Suppurative Appendicitis Perforated by a Calcified Fecalith. Harold J. Shelley. Surg., 3, 658-662, May, 1938.

The author reports a case of calcified fecalith of the appendix, which was found to have ruptured, with resultant generalized peritonitis. The patient had been examined four months previously but the fecalith was overlooked. It was also present on a film made just before the operation. At the time of operation it was found protruding through the site of the rupture of the appendix. Twelve other reports have been found in the literature.

JOHN E. WHITELEATHER, M.D.

BIOLOGIC EXPERIMENTATION

Radiobiological Experiments with the Pupæ of *Drosophila*. A. Liechti, W. Minder, and J. H. Müller. Strahlentherapie, 63, 689, 1938.

Pupæ of *Drosophila* were exposed to ultra-violet rays, Grenz rays, two qualities of x-rays, and gamma rays of radium in order to check the results obtained in similar experiments on *Ascaris* eggs and also in an attempt to test, experimentally, the target theory. A quartz mercury vapor lamp served as the source of ultra-violet radiation. It appeared that the pupæ of *Drosophila* were very sensitive to these rays since an exposure of 11 minutes produced mortality of 50 per cent. Little can be said about the character of the mortality curve since no dose unit for light rays is available at this time. Grenz rays were produced at 11 kv. with an output of 200 r/min. at 10 cm. distance. For 50 per cent mortality approximately 4,000 r of Grenz rays are required. The mortality curve is somewhat similar to that obtained with ultra-violet rays because it shows a steep rise with small doses. X-rays were produced at 80 kv. (no filter) and 190 kv. (1 mm. Cu). For the penetrating radiation 2,800 \pm 300 r were required for a 50 per cent mortality, while the corresponding figure for the unfiltered radiation amounted to 2,500 \pm 200 r. Radium applicators of 160, 180, and 200 mg. were available and filtered through 1.0 mm. Pt. For the calculation of the dose in r, it was assumed that 1 mg.-hr. corresponds to 7.5 r. The dose required for a 50 per cent mortality amounted to 4,250 r. This unusually high value can probably be explained by the influence of the time factor.

An attempt of the interpretation of the results is

given, with numerous mathematical deductions. Although the results of the experiments seem to speak in favor of the target theory, no definite stand is taken by the authors for or against this theory.

ERNST A. POHLE, M.D., Ph.D.

BONE DISEASES (DIAGNOSIS)

Diffuse Cystic Enlargement of the Mandible in a Senegalese. Castay. Jour. radiol. et d'électrol., 22, 556, 557, November, 1938.

This is the case of a Senegalese rifleman, 24 years of age, who complained of painless enlargement of both horizontal portions of the mandible over a period of two years. X-ray examination showed marked enlargement of the mandible, with many small and large multilocular clear cysts. The cortex was intact but markedly thinned and no periosteal reaction was present. The vertical rami of the mandible were not involved. The rest of the skeleton showed no similar lesions. Due to the fact that the Wassermann was positive, anti-syphilitic treatment was given for three months, but it produced no change in the appearance of the mandibular lesions, suggesting that they were not syphilitic in origin.

The author feels that the condition most likely represents localized osteitis fibrosa cystica of the mandible but the final diagnosis must wait until biopsy is done.

J. SAGEL, M.D.

Course of Polycythemia. Nathan Rosenthal and Frank A. Bassen. Arch. Int. Med., 62, 903-917, December, 1938.

Polycythemia is a very chronic disease of the bone marrow which may be either asymptomatic or symptomatic, and which may last for a number of years. The diagnosis has to be made in the active stages since the blood picture is the only criterion. The disease may exist in spite of a perfect feeling of well-being. During the symptomatic or polycythemic stage, roentgen findings may be those of an increase in the vascular markings of the lungs. Polycythemia, after a varying amount of time, causes the patient to come to one of several clinical conditions, as a result of either leukopoietic and megakaryocytic hyperactivity or of exhaustion of the erythropoietic system. The terminal stages of the disease may have manifestations of a leukemia, a thrombocythemia, an anemia, or any combination of these. The author gives a brief review of the literature and reports 13 of a series of 75 cases, illustrating the various stages of the disease.

C. W. REAVIS, M.D.

Radiologic Aspects of an Almost Total Osteoperiostitis Associated with Hypertrophy of the Palpebral Tarsi, the Skin of the Face and Extremities: A New Syndrome. J. N. Roy and Albert Jutras. Jour. radiol. et d'électrol., 22, 539-549, November, 1938.

The authors report the case of a man, 57 years of age,

presenting cutaneous hypertrophy of the face and extremities, keloid hypertrophy of the palpebral tarsi, and osseous dystrophy, predominantly hyperplastic, affecting a large number of bones, particularly those of the extremities. Exaggerated development of the head, wrists, and ankles was noted at the age of three years and facial wrinkling appeared at the age of 18. At the age of 20 his eyes were severely irritated by smoke, resulting in conjunctival hyperemia with itching, lacrimation, and photophobia. Six months later, thickening and rigidity of the eyelids appeared. At the age of 22, the bony hypertrophy was arrested and since then there has been no change in the size of his hands and head. Physical examination was essentially negative except for the systems noted above.

X-ray examination showed a bilateral bone dystrophy, predominantly hyperplastic and nearly symmetrical, with the greatest change in the long bones. The bone diameter was considerably increased with the increase most marked at the distal ends. The change of structure involved the medulla, cortex, and periosteum. The medullary cavity was widened and encroached on the cortex, which was thinned, dense, and trabeculated. The periosteum showed new bone formation which was irregular and spicular, up to 7 or 8 mm. in thickness, and resembled osteomyelitis somewhat.

Virchow observed bone and skin changes which he called "leontiasis ossea," and others have seen similar cases, but none mentioned the tarsal lesions except in a superficial manner.

In the differential diagnosis are to be considered Paget's disease, von Recklinghausen's disease, acromegaly, pulmonary osteoarthropathy of Marie, melorheostosis of Leri, and osteopetrosis of Schoenburg. However, all of these can be excluded by careful x-ray and clinical examination.

As to etiology, the authors favor an endocrine basis, with special emphasis on the parathyroids, hypophysis, and thyroid and perhaps the genitals, although none showed evidence of gross pathology. As to the palpebral lesion, they assume that the long-standing conjunctivitis from smoke fumes simply favored fibrous transformation.

No treatment seemed indicated since the condition was arrested. The eyes were treated symptomatically.

Abstractor's Note: To me, it is questionable whether this is a new entity and might perhaps better be classified under one of the bone dystrophies mentioned above. The tarsal palpebral changes can be explained separately.

J. SAGEL, M.D.

The Frontal Hyperostosis Syndrome. Harvey M. Salzer. *Jour. Med.*, 19, 507-510, December, 1938.

This syndrome consists in a thickening of the internal table of the cranial bones, especially the frontal, with mental changes, and indefinite neurologic findings. It is found most commonly in women. Obesity is found in 44 to 64 per cent of the cases and headache in 62 per cent.

The four different types into which the condition is divided are listed as: (1) nebula frontalis or frontal cloud; (2) hyperostosis frontalis interna; (3) hyperostosis fronto-parietalis, and (4) hyperostosis calvariae diffusa. According to Canavan, who found that only 7 per cent of his group had obesity and neurologic disturbances, the mere presence of hyperostosis does not seem a criterion for the grouping.

With increase in bone formation, the diploe is decreased and the cranial contents are encroached upon. The degree of hyperostosis is related to the intensity of symptoms and both are progressive. The cause and mechanism of the condition are unknown.

Diagnosis is made from x-ray examination and by the exclusion of other conditions. Parathyroid hormone may be tried therapeutically, as may also glycine.

Four case histories are presented and discussed.

JOHN McANENY, M.D.

CALCIFICATION

Calcification of the Bursa of the Coracoclavicular Ligament. H. J. McCurrich. *British Jour. Surg.*, 26, 329-332, October, 1938.

This is an unusual case of calcification located in a more mesial position than the fairly common calcification in the tendon of the supraspinatus muscle. In the case reported there was a history of trauma to the left shoulder, followed three months later by the appearance of a globular hard mass below the outer third of the clavicle. At operation, the calcified mass was found to be attached loosely to the coracoid process and it was shelled out without difficulty. The roentgenograph showed a large calcified deposit lying between the clavicle and the coracoid process which was diagnosed as a subacromial bursal calcification. Anatomists mention a bursa between the coracoid and trapezoid ligaments, referred to as a bursa of the coracoclavicular ligament, and the author, therefore, believes this to be a rare case of calcification of this bursa.

MAX CLIMAN, M.D.

CANCER (THERAPY)

Results of Roentgen and Radium Therapy in Carcinoma of the Larynx and Hypopharynx. R. Müller. *Strahlentherapie*, 63, 483, 1938.

The author presents a statistical analysis of the cases of carcinoma of the vocal cords seen in the Tumor Clinic of the University of Berlin since 1929, and of the cases of carcinoma of the larynx and hypopharynx treated since June, 1933. In cases with vocal cord involvement he used a 6 mg. radium plaque filtered through 1 mm. Au which remains 8 times 24 hours in the larynx. The normal tissue is protected by 1 mm. of lead. More recently this has been changed to a radium applicator of 9.3 mg. which is applied 7 times 24 hours for a total dose of 1,564 mg.-hr. Implantation of radium needles or seeds is not advocated. From 1929 to 1936, 103 cases were treated in this manner. After three years 73.9 per

cent were well and 58.2 per cent were well after five years.

In carcinoma of the larynx and hypopharynx roentgen therapy applied with simple fractionation was used (180 kv., 3-4 ma., 0.5-1.0 mm. Cu, 30-60 cm. F.S.D., $4 \times 5-10 \times 15$ cm. fields). The daily dose per field varied from 120 to 400 r and the total treatment period from 14 days to 17 weeks. The radiation was applied at rates varying from 5 to 37 r/min. Consequently the total doses given varied considerably: from 4,200 to 16,800 r on the surface. Since 1937 the following technique has been used: 180 kv., 10 ma., 40 cm. F.S.D., 0.5 mm. Cu, 250 r per field, with a total dose of 4,000 r on each side of the neck. Each sitting takes 4 min. and the total dose effective in the tumor is 4,075 r. Of 61 cases observed for five years, 53.8 per cent remained free from symptoms or recurrence. The author concludes that these results are at least as good as those obtained by surgery.

ERNST A. POHLE, M.D., Ph.D.

CONTRAST MEDIA

The Limitations and Dangers of Mammography by Contrast Media. Samuel A. Romano and Elizabeth M. McFetridge. *Jour. Am. Med. Assn.*, 110, 1905-1910, June 4, 1938.

Mammography is the radiographic demonstration of tumors of the breast after injection of the ducts with some opaque medium. Stabilized colloidal thorium dioxide (thorium dioxide sol, thorotrast) was the medium of choice. Primarily to establish the practical value of mammography in the diagnosis of borderline cases in which the diagnosis was often difficult and the results of diagnosis momentous, the authors undertook its use in a series of patients. Their material consisted of 25 clinical cases in which 85 roentgenograms were made. Their experience did not impress them as of value in these borderline cases, the variety in which some diagnostic aid would be most welcome. In none of their group of cases did the use of this method add anything of great value to their knowledge. Furthermore, possible misinterpretation of the radiographic studies might have given rise to serious consequences had they been relied on alone.

CHARLES G. SUTHERLAND, M.D.

Studies in the Evaluation of Mammography. Ralph A. Reis and Sidney D. Mesirov. *Jour. Am. Med. Assn.*, 110, 1900-1905, June 4, 1938.

Colloidal thorium dioxide, lipoiodine, hippuran, diodrast, bismuth oxychloride, 15 per cent sodium iodide, and air have been used: colloidal thorium dioxide was found the least irritating and most suitable because of its fluidity, which permitted the filling of the smallest lacteal ducts and acini, while of sufficient density to cast satisfactory shadows.

The combined appeal of safety, simplicity, and ac-

curacy of diagnosis led to investigations in a series of patients. Colloidal thorium dioxide may remain in the breast for as long as five months after injection (as much as a year, in fact). It is the source of considerable physical and mental discomfort to the patient. Histologic studies show the progressive development of a granulomatous change in response to the presence of the radio-active material, with a varying degree of tissue necrosis.

Mammography by means of colloidal thorium dioxide would seem to be fraught with potential danger and, therefore, an unsafe procedure.

CHARLES G. SUTHERLAND, M.D.

Acute Iodism Following Intravenous Pyelography. Lamarque, Guibal, and Bétoulières. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 78-80, January, 1938.

The authors report a case of acute reaction following intravenous administration of 10 c.c. of 35 per cent perabrodil, characterized by congestion of the face and conjunctiva, cough and dyspnea followed by urticaria, vomiting, hyperperistalsis, weakening of the cardiac action, and cyanosis. This type of reaction is rare following injection of substances containing iodine and is probably an expression of hypersensitivity.

S. R. BEATTY, M.D.

DOSAGE

Dosimetric and Radiobiologic Experiments with Fast Neutrons.—I. K. G. Zimmer. *Strahlentherapie*, 63, 517, 1938.

The investigations of the author seem to indicate that small ionization chambers, the walls of which are made of substances containing hydrogen, are suitable for measuring fast neutrons. A comparison between the results obtained by the ionization method with those obtained by means of the Ag-indicator showed an agreement within 20 per cent. By using a 1-2.0 (15 Aerion) condenser chamber, the author found that an ionization current of 1 E.S.U. for 3.9 million volt neutrons corresponds to an ionization in tissue of approximately 1.8 r.

ERNST A. POHLE, M.D., Ph.D.

Dosimetric and Radiobiologic Experiments with Fast Neutrons.—II. K. G. Zimmer and N. W. Timoféeff-Ressovsky. *Strahlentherapie*, 63, 528, 1938.

The authors studied the effect of fast neutrons on mutations produced in the fruitfly. There was a definite increase in the rate following exposure to fast neutrons which was directly proportional to the dose. The effect per dose unit or per pair of ions produced in tissue was less than that of roentgen or gamma rays. The experimental results were in good agreement with those calculated, according to the target theory.

ERNST A. POHLE, M.D., Ph.D.

EPILEPSY

Experience with Roentgen Therapy in Epilepsy. M. Sgalitzer. *Strahlentherapie*, 62, 667, 1938.

During the last 11 years the author has treated 78 cases of epilepsy by roentgen rays. Nineteen of these patients were considerably improved, 33 improved, and 26 did not respond. The author recommends the use of 4-5 large fields of entry of about 7×11 cm. at from 170 to 180 kv., 0.5 mm. Zn + 1 mm. Al at 30 cm. F.S.D.; 50 r per field. One area is given per day and if the treatment is tolerated well he repeats this same series twice, applying 100 r per field. He divided his cases into eight groups: those on a traumatic basis; those due to degenerative process on a hereditary basis; those in conjunction with hydrocephalus; those due to tumors; those due to inflammatory processes; those due to dysfunction of endocrine glands; those due to toxic agents, and finally, the true Jacksonian forms. He found that patients who had hydrocephalus; in other words, a disturbance of the water metabolism in the brain, responded best. Strict individualization of the treatment is essential.

ERNST A. POHLE, M.D., Ph.D.

Cranial and Spinal Lesions in an Epileptic: Difficulties of Interpretation. R. Raynaud, A. Huguenin, and H. Tillier. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 175-177, March, 1938.

In the case of an epileptic 65 years of age, evidences of cranial fracture, localized cranial osteoporosis, and localized wedging and arthritis of the spine were found. The authors discuss the possible relationship of these lesions to the epilepsy.

S. R. BEATTY, M.D.

Roentgen Therapy of Epilepsy. W. von. Weiser. *Strahlentherapie*, 62, 649, 1938.

The author reviews the literature regarding roentgen therapy of epilepsy. He presents a summary in a table covering 185 cases reported by 12 different investigators. Of this number 33 per cent were cured, 39 per cent improved, and 28 per cent were not benefited by the treatment. He uses five fields over the skull 6×8 cm., 180 kv., 0.5 mm. zinc and 50 cm. F.S.D. As an initial dose he applies 15 r on the skin. In another table he analyzes the relation between total dose applied and response of the patient. The doses vary from 15 to 4,500 r and the author points out that occasionally the single dose of 15 r might suffice while other patients require prolonged treatment. The etiology of the disease apparently did not influence materially the percentage of good results; the analysis includes cases due to trauma, true Jacksonian epilepsy, and epilepsy on an inflammatory basis. In conclusion the author states that roentgen therapy of epilepsy must be considered a recognized method of treatment.

ERNST A. POHLE, M.D., Ph.D.

THE FOOT

Fractures of the Os Calcis. Duncan C. McKeever. *Jour. Missouri Med. Assn.*, 36, 7-9, January, 1939.

Fracture of the os calcis should always be suspected in the presence of any foot disability resulting from a fall, even from a relatively insignificant height, in which the patient lands on the feet. Roentgen examination should always be done in such cases. The lateral view may show little if any visible displacement. The most information is obtained from the anteroposterior film, made by directing the rays from above and distal to the os calcis at an angle of approximately 45 degrees from the vertical. This view should be taken of both feet for comparison. Reduction should be carried out at once, if possible. The normal angle of relation of the os calcis to the body of the foot must be restored. This is the so-called "tuber angle" and is about 140 degrees. Also, the widening, or mushrooming, of the bone which is responsible for such a great part of the disability must be corrected.

The author describes his method of reduction, which consists of manipulation under anesthesia and the use of skeletal traction by means of a hook which is inserted into the heel anterior to the Achilles' tendon. Widening is corrected by means of a clamp.

LESTER W. PAUL, M.D.

Variations in the X-ray Appearance of the Normal First Metatarso-phalangeal Joint Due to Changes in the Direction of the Central Ray. Bengt S. Holmgren. *Acta Radiol.*, 19, 67-72, March, 1938.

Emphasizing that anatomic and radiologic descriptions of the first metatarsal are often incorrect or incomplete the author demonstrates that slight changes in the adjustment and position of the tube produce marked variations in the roentgen picture of the metatarsal capitulum.

ERNST A. SCHMIDT, M.D.

GALL BLADDER
(NORMAL AND PATHOLOGIC)

Error of Technic in the Administration of Tétraiodide with Intolerance and Prolonged Visibility of the Gall Bladder. Nemours-Auguste. *Bull. et mém. Soc. Radiol. Méd. de France*, 26, 14, 15, January, 1938.

Through error a patient ingested 7 grains of tétraiodide in 12 hours. Nausea, vomiting, diarrhea, and syncope followed. Adrenalin, camphor and sugar were administered. Roentgenographs two days following showed no emptying of the gall bladder despite repeated evacuation meals.

S. R. BEATTY, M.D.

Calcium Carbonate Deposits in the Human Gall Bladder. A. T. Cameron, F. D. White, and Sara Meltzer. *Canadian Med. Assn. Jour.*, 39, 441-446, November, 1938.

The authors believe that the metabolic aberration leading to calcium carbonate deposition in the gall bladder must be different from that leading to the deposition of a calcium soap. They advocate the chemical examination of all gall-bladder stones, and stress the need of further clinical and experimental studies to elucidate the mechanism of calcium carbonate deposit. Two of their own cases and a classification of cases reported by others are presented.

M. CONNELLY, M.D.

The Danger of Intravenous Cholecystography. W. Lutz and H. Seyfried. *München. med. Wchnschr.*, 85, 1019, 1020, July 8, 1938.

This is a case report of a 68-year-old man who entered the hospital for decompensated heart disease. After improvement under strophanthin, he was given intravenously drugs for cholecystography; he had acute heart pain and died 14 minutes later. From clinical and autopsy findings the authors conclude the drug induced coronary spasm. They warn against disregarding the contra-indications for cholecystography.

LEWIS G. JACOBS, M.D.

GAS GANGRENE

The Treatment of Gas Gangrene Infections. J. J. Faust. *Texas St. Jour. Med.*, 34, 404-408, October, 1938.

Seven cases of gas gangrene are reported and the subject of treatment discussed. Early operation is discouraged. Gas gangrene serum and tetanus antitoxin are useful, but it is x-ray therapy that has improved results.

X-ray treatments should be started early and given frequently—two or three treatments daily for three or four days. An area larger than that of apparent involvement is treated, 45 r being administered at one treatment. The presence of an associated colon bacillus infection makes the case much more difficult to treat successfully.

JOHN M. MILES, M.D.

Radiological Aspect of Early and Advanced Gas Gangrene. Adamo Grlli. *Radiol. Med.*, 25, 843-850, September, 1938.

Several very important points are brought out by the author, the outstanding one the value of roentgenological examination in determining an early diagnosis of gas gangrene. The gas shows in the radiograph as a light, rounded shadow, or several such confluent shadows, at the site of the wound, or even at some distance from it. The author concedes the eventuality of air or oxygen, when peroxide is used to treat the wound, finding its way into the soft tissues in compound fractures, and the possibility of its being mistaken for early gas gangrene. However, he observes that if a second film is made six hours later, in cases of gangrene, the accumulation of gas increases, while air or oxygen would be

absorbed. Therefore, in the latter case the size of the translucent bubbles decreases or they may disappear.

As time passes and the infection advances, gas will be seen infiltrating the space between the muscular fasciculi, the subcutaneous tissue, or extending along the vessel or nerve sheaths. X-ray films are of particular importance in demonstrating this route of spread, which will have a very important bearing on deciding the site of amputation.

The simplicity of the technic, the rapidity with which it is accomplished, and the accuracy in diagnosing the condition, make this a highly commendable proceeding.

ANTONIO MAYORAL, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Radiology of the Gastro-intestinal Tract: The Value of Co-operation. S. J. Boland. *Irish Jour. Med. Sci.*, 154, 670-673, October, 1938.

In speaking of co-operation Boland has reference chiefly to the proper preparation of the case in regard to history, physical examination, and pertinent laboratory studies, so that the radiologist may be properly directed in his investigation. It is insisted that the radiologist is a physician and not a mere technician.

The proper preparation of the patient for a barium enema, barium meal, and gall-bladder study is outlined and discussed. The article presents nothing new in radiology but it is instructive to the general practitioner for whom it was probably intended.

J. B. MCANENY, M.D.

Multiple Diverticula of the Digestive Tract. G. Ronneaux and Witasse. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 207-209, April, 1938.

A case which illustrates the probability of not visualizing diverticula of the upper gastro-intestinal tract on fluoroscopic examination in the upright position only, is presented. This case also demonstrates that diverticulosis of the duodenum is frequently an indication of a general diverticulosis of the entire intestinal tract which can be demonstrated by the proper technic of examination.

S. R. BEATTY, M.D.

Diverticulum of the Duodeno-jejunal Angle. G. Dumont. *Jour. de radiol. et d'électrol.*, 22, 552-555, November, 1938.

This is a case report of a man, 67 years old who had had gastro-intestinal trouble for 28 years. The past history otherwise was essentially negative. Ten days before admission to the hospital he developed an acute attack of pain in the left hypochondrium, followed by two large black stools within an hour.

X-ray examination showed a normal stomach and duodenal bulb. In the region of the lower pole of the stomach, along the greater curvature, there was definite tenderness on deep palpation over a shadow which at

first was thought to be an ulcer niche. However, on further examination, this shadow was identified as a diverticulum of the duodeno-jejunal angle which was well shown in several films made in the upright and recumbent positions. Examination at 24 hours showed retention of a little barium in the diverticulum.

Differential diagnosis includes ulcer niche, ulceration within a carcinoma, and a cicatrix. Ulcer beyond the inferior angle of the duodenum is rare, whereas congenital diverticula predominate here. Also, a true diverticulum has more regular rounded contours than an ulcer niche. The stagnation of barium within a diverticulum is a very important point which has been emphasized by Forsell. The stagnation of food within a diverticulum predisposes to inflammation, ulceration, and malignant degeneration.

Medical treatment consists in the administration of bismuth, kaolin, and atropine. Surgical treatment is the only cure but is not without danger and should be reserved for those cases which have a great deal of pain.

J. SAGEL, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

The Late Effects of Acute Pyelitis in Girls. Lawrence R. Wharton, Laman A. Gray, and Harriet G. Guild. *Jour. Am. Med. Assn.*, 109, 1597-1602, Nov. 13, 1937.

A study was made of the late effects of uncomplicated urinary infection in fairly normal and healthy children.

In the authors' series the after-effects of pyelitis appeared to be more grave than they had anticipated. Only one of 30 was really incapacitated from usual activity; all but two were in average, good, or excellent health. The persisting lesions were slight but definite.

They advised that after symptomatic recovery is complete and after a child has been well for several months (long enough to throw off the infection completely, if possible), a follow-up study should be made and, if a residual lesion is found, it should receive appropriate treatment.

CHARLES G. SUTHERLAND, M.D.

Non-obstructive Dilatations of Upper Urinary Tract in Children. Alexander B. Hepler. *Jour. Am. Med. Assn.*, 109, 1602-1606, Nov. 13, 1937.

From the etiologic standpoint, dilatations of the upper part of the urinary tract in children may be divided into three groups: (1) those due to mechanical obstruction, most frequently congenital fibrosis, muscular hypertrophy, or exaggerated constriction at the points of normal anatomic narrowing, the ureteropelvic and the ureterovesical junctions, and the vesical outlet; (2) those that are a sequence of neurologic lesions either central or peripheral involving the bladder, such as poliomyelitis, cerebrospinal syphilis, spina bifida, toxic neuritis or the less definite dysfunctions classified as idiopathic; (3) those in which no obvious cause either mechanical or dynamic can be demonstrated.

Two types of functional imbalance at the ureterovesical junction are recognized: (1) increased tonicity, or spasm, and (2) absence of the usual active relaxation synchronous with the termination of ureteral peristalsis, or achalasia.

The resistance to ureteral emptying caused by these dysfunctions sets in motion the same physical and dynamic factors which produce dilatation in the mechanical obstructions. Compensation is more apt to occur in the functional imbalances than in the mechanical obstructions, because resistance to ureteral emptying is apt to be less unyielding; hence the observation of ureterectasis out of proportion to the pelvic dilatation and the absence of elongation and tortuosity.

In some cases, congenital idiopathic dilatation considered as a primary embryologic developmental defect may in fact be secondary to a segmental imbalance or abnormal activity of the sphincter.

The association of megalocolon and megaloureter in one child is of interest in view of the contention that the mechanism of their pathogenesis is similar.

CHARLES G. SUTHERLAND, M.D.

Two Cases of Cystic Dilatation of the Lower Thirds of the Left Ureters. Eugen Herskowitz. *Röntgenpraxis*, 10, 671-674, October, 1938.

Ureteral cysts close to the bladder, the so-called ureteroceles, have been noted by pyelography, according to v. Lichtenberg, in about four out of every 1,000 cases.

In two cases described by the author there was a typical dilatation of the left lower ureter without evidence of strictures. These ureteroceles are thought to be caused by a congenital weakness of the connective tissue and musculature of the ureter. If they exist for a long enough time they may lead to a hydro-nephrosis due to stasis.

HANS W. HEFKE, M.D.

GYNECOLOGY AND OBSTETRICS

Metrorrhagia Cured by Radiotherapy: Subsequent Pregnancy. Dano and Lainé. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 231, 232, April, 1938.

A corpulent woman who had been treated by roentgen therapy to the pelvis for persistent metrorrhagia became pregnant two years after treatment and was delivered (forceps) of a normal infant. A total of 5,500 r had been given to four pelvic fields over a period of three months before temporary amenorrhea had been established.

S. R. BEATTY, M.D.

A Case of Hemorrhagic Metritis Cured by Roentgen Irradiation of the Hypophysis. J. Moro and Monmignaut. *Bull. et mém. Soc. Radiol. Méd. de France*, 26, 9, 10, January, 1938.

A young woman 18 years of age who for two years had had menstrual irregularity and menorrhagia, not responding to other treatment, was treated by irradiation.

tion to the hypophysis. Each temporo-parietal field was given one treatment of 150 r a week for six weeks. (Spark gap 25 cm., 2.5 ma., 30 cm. F.S.D., 0.5 mm. Cu + 1 mm. Al filter.)

Profuse bleeding in the fourth week responded to 200 r to the spleen. The menstrual periods have been normal in interval, duration, and amount for over a year.

S. R. BEATTY, M.D.

Practical Employment of Radiographic Diagnosis in Obstetrics. P. Brault and A. Tizon. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 240-253, April, 1938.

The diagnosis of pregnancy before four and a half months is very seldom made roentgenographically and later only occasionally is roentgenographic confirmation necessary. Roentgen pelvimetry is seldom employed, as the clinical measurements and trial of labor are preferred by most obstetricians.

In many cases, it is well, however, to determine the size and shape of the pelvis and the size, presentation, and position of the fetus so that the patient can be hospitalized if any abnormality is present.

Without roentgenographs, the diagnosis of exact type of abnormality of the pelvis, the presence of multiple fetuses, hydramnios, fetal abnormalities, and abnormal presentations and positions is often impossible, especially in very fat women or in primiparae. Such information is often indispensable to the proper conduct of delivery.

S. R. BEATTY, M.D.

HEART AND VASCULAR SYSTEM

The Action of Digitalis on the Isolated Heart. L. N. Katz, M. Mendlowitz, and H. A. Kaplan with the Assistance of K. Jochim and E. Lindner. *Am. Heart Jour.*, 16, 149-158, August, 1938.

The authors establish an isolated heart circuit and introduce into this circuit first, digifoline, digoxin, and then ouabain in doses of from one-half to one cat unit. Unfortunately, these studies in any instance have not been for longer than 79 minutes. In the preparation, which showed no heart failure, there was no significant change in heart size, flow, work, oxygen consumption, or mechanical efficiency until the toxic effects on conduction began to appear. When the work of the heart was kept constant, digitalis produced no change in the oxygen consumption or efficiency. As in the one control experiment without the administration of digitalis, these factors both remained constant in spite of progressive increase in heart size and venous pressure. The ratio, work over oxygen consumption, *i.e.*, the mechanical efficiency, as in heart failure without digitalis, remained unchanged in failure with digitalis.

It is apparent that in this preparation digitalis did not have any significant effect on the contractility of the heart muscle, whether the heart was in failure or

not. Its only direct effect appeared to be on the conduction system and the ectopic pacemakers of the heart.

The authors by this bit of work have raised a definite objection to our modern views of digitalis therapy. Certainly the question should be further investigated before we blindly accept the fact that digitalis has some definite action on the heart other than through its pacemaker.

W. H. GILLENTE, M.D.

Systolic Expansion of the Heart's Ventricles. Alberto C. Morelli. *Rev. Argent. de Cardiol.*, 5, 97-109, May-June, 1938.

Morelli believes that a span has been bridged in the study of the heart by the development of the kymograph. It fills the gap between the flat 6 ft. films and screen examinations. The "lagging" makes it impossible during the latter examinations for the human eye to perceive and differentiate rapid movement.

The author studied 2,000 cardiographs. Of these, ten showed an altered or abnormal curve of the left ventricle and eight showed it of the right. Taken as a whole, the study revealed that one in every 111 patients showed an abnormal systolic curve. A careful check, either clinically or by autopsy when this was possible, revealed that, of the ten patients showing alterations on the left ventricular curve, in four it was due to small amounts of pericardial fluid; in three, to coronary disease; in one, to adhesive pericarditis, and in one, to hydatid cyst in the pericardium resting on the pulmonary artery. In the last one, it was due to a similar cyst opening into the ventricle. Of the eight cases showing the condition on the right side, all showed congenital malformations of the interventricular wall.

ANTONIO MAYORAL, M.D.

The Saccular Aneurysms of the Internal Carotid Artery in the Cavernous Sinus. Geoffrey Jefferson. *British Jour. Surg.*, 26, 267-302, October, 1938.

The author's paper is founded on 17 cases. Altogether, 55 cases of intracranial aneurysm have come under his care during the past 15 years. Symptoms are referable to cranial nerve involvement, the most frequent being the trigeminus and occasionally the superior division of the oculomotor nerve.

X-ray evidence of the presence of an aneurysm was found in 10 cases. The calcified wall of the aneurysm is visualized only in cases of several years' duration. The calcification in the infra-clinoid aneurysms is parasellar and usually shows up as a more or less regular line, narrow but dense, a true picture of the cortex of the aneurysm. The parasellar situation eventually leads to a certain amount of sellar deformation. Enlargement of the superior orbital fissure and erosion of the lower and outer wall of the optic canal can be demonstrated by axial views. Angiography by means of injection of thorotrast into the carotid arteries was employed in several cases and proved s

lishing the diagnosis. Lateral films are taken with the patient supine and the rays directed horizontally. The aneurysm shows as an opaque area of varying size covering the sella turcica.

MAX CLIMAN, M.D.

The Diagnosis of Cardiac Enlargement. W. Frey. Schweiz. med. Wchnschr., 68, 823-825, July 16, 1938.

A discussion of the measurement of the size of the heart by roentgen examination. The author concludes that Groedel's lung-heart ratio is the best measure, but since he has adduced no original data in support of his contention and has ignored all the later American work (especially that of Bardeen, Hodges and Eyster, Frey, Roesler, and Kurtz), the validity of his conclusion is open to question.

LEWIS G. JACOBS, M.D.

Dissecting Aneurysm of the Aorta: Its Clinical Recognition. Arthur J. Patek. Wis. Med. Jour., 37, 1080-1086, December, 1938.

Recent statistics regarding the frequency of dissecting aneurysm of the aorta range from 1 : 350 to 1 : 550 in autopsies on adults. Up to 1934, but ten cases of dissecting aneurysm of the aorta were reported as having been recognized before death. In recent years this number has been considerably increased by reason of greater publicity given to recognized cases and more detailed description of their clinical course.

Among etiologic factors atheromatous degeneration of the aortic walls has been found in many cases; in young individuals congenital anomalies such as coarctation of the aorta may be the predisposing factor. Mycotic infection of the intima has also accounted for a large number of cases. The separation of the medial layers may be very extensive and may extend into the carotid and brachial arteries or down to the common iliac and popliteal arteries. Healing may take place by absorption of the extravasated blood and fusion of the layers of the media. Commonly, the symptoms are dramatically sudden in their onset. Pain localized in the chest or radiating into the back, shoulders, arms, legs, and abdomen is agonizing in character. There may be loss of pulsation in an extremity, coldness, and numbness. Other symptoms are coma or collapse with nausea and vomiting, bloody fluid in the left pleural cavity, a persistently elevated blood pressure without an elevated heart rate, and in many instances a relatively normal electrocardiogram. The author reports two cases in detail with illustrative roentgenograms.

LESTER W. PAUL, M.D.

INFECTIONS

Coccidioides Infection (Coccidioidomycosis). II.—The Primary Type of Infection. Ernest C. Dickson and Myrnie A. Gifford. Arch. Int. Med., 62, 853-871, November, 1938.

The fungus coccidioides causes both primary and

secondary manifestations of a disease which is rather mild in its course but which may cause death as a coccidioides granuloma. The organism goes through two cycles, one of which is developed in man, and the other in the vegetative state outside the body. This latter, the chlamyospore, is dust-transported and is frequently inhaled into the lungs, thereby causing symptoms which may be mistaken for a severe cold or influenza. There may be an associated bronchitis with productive sputum; an erythema nodosum occurs and then disappears in four or five days. Coccidioidin may be used similar to tuberculin as a diagnostic aid. The authors report eight cases in abstract, all of which occurred in the San Joaquin Valley region of California.

A roentgenogram of the chest at the time of the erythema nodosum reveals opacities which simulate those of tuberculosis. There may be evidence of hilar gland enlargements, scattered shadows indicating parenchymal involvement, or even signs of pleuritic effusion. However, the roentgenograms are generally clear in from one to several months.

C. W. REAVIS, M.D.

THE KIDNEY

Heminephrectomy in Disease of the Double Kidney. Edwin Beer and William H. Mencher. Ann. Surg., 108, 705-729, October, 1938.

In a series of 104 cases of double kidney, 14 were subjected to heminephrectomy. The authors believe that double kidney occurs in from 3 to 4 per cent of all autopsies. In the series of 104 cases, symptomatology occurred in 60 per cent and operative therapy was carried out in 25 per cent of all cases. In contradistinction to reports in the literature, the majority of the pathology occurred in the lower pole.

The anatomy and diagnosis of double kidney are discussed. The contra-indications to heminephrectomy are: tuberculosis, except the presence of a solitary kidney in which there is no involvement of the other half; malignant tumors; non-function of the remaining portion of the kidney; single blood supply to both poles; technical difficulty in separating the two halves of the kidney; advanced disease of both halves, and communication between the two pelves.

The operative technic is described. The 14 cases are outlined in full and their corresponding urograms illustrated. A cystoscopic follow-up of ten of the cases showed a good function of the remaining portion of the kidney.

The authors conclude that conservatism is indicated in instances of double kidney.

JOHN G. MENVILLE, M.D.

Renal Carcinoma: A Study of Ninety-five Cases, with Follow-up Notes on Thirty-six. Theodore R. Fetter. Jour. Am. Med. Assn., 110, 190-196, Jan. 15, 1938.

The diagnosis of renal neoplasm resolves itself into

three distinct phases. A complete clinical history is absolutely essential, particularly if hematuria is a prominent symptom. One must emphasize the need for a complete physical examination. The third phase of the diagnosis, a complete urologic examination, includes cystoscopy, retrograde pyelography, intravenous urography, renal function studies, and urine, blood, and dye elimination tests. One should be careful in placing too much faith in the interpretation of intravenous urograms in the case of renal tumor. Better results in pre-operative diagnosis due to the use of the excretory (intravenous) urogram occur in clinics where there is thorough appreciation of the shortcomings of urography. The retrograde pyelogram, with its precise and minute detail of the kidney pelvis and its calices, is still the best method of approaching a more correct diagnosis of renal tumor. The highest degree of efficiency of a retrograde pyelography can be attained by practising pyeloscopy. Injections should be done under fluoroscopic visualization.

The interpretation of pyelograms requires the combined skill of the roentgenologist and the urologist. The diagnosis of renal tumor depends on some degree of deformity in the pelvis or the calices as revealed by the injected opaque solution. There are several types of deformities. First, and perhaps most characteristic, is the elongation of one or more calices. The next most common deformity is the complete obliteration of one or more calices, with the defect having, as a rule, a smooth outline at the base of the calix or at the adjacent pelvis. Cystic tumors are apt to produce such a deformity; it may involve more than one portion of the pelvis and calix outline. Frequently there are small crescent-shaped borders of the shadow of the opaque fluid. These are diagnostic only when they are constant in a series of exposures. Another type of deformity, the third, is a dilatation of a calix due to pressure obstruction at a proximal point. One calix may dilate to a large extent and perhaps all the rest of the pelvis and the calices, so that all of the natural shape of the pelvis is distorted and the opaque solution seems to take on a wavy appearance throughout a considerable area.

In addition to elongation in the first type, the lumen is narrowed. This may simulate a normal calix in a state of contraction.

The differential diagnosis of extrarenal tumor is based entirely on palpation during the injection under fluoroscopic control. This is also true in the case of a rotated kidney. The differential diagnosis of retroperitoneal masses from renal neoplasms is difficult because of the possibility of extension of the renal tumor in the surrounding tissues. A thorough search for metastasis must be undertaken; the lungs are the most frequent site and the osseous system a less frequent site.

It is well to bear in mind that negative evidence of the excretory urograms does not necessarily mean that the kidneys are not the seat of any lesion. Gastro-intestinal symptoms without accompanying urinary symptoms, but with generalized weakness, loss of weight, and negative results of x-ray examination of

the gastro-intestinal tract, should impress the attending physician with the necessity of investigation of the urinary tract.

The management of renal neoplasms has to-day resolved itself into three major groupings: first, pre-operative and post-operative irradiation with surgical intervention; second, operation with subsequent irradiation, and third, irradiation alone, used only when operation is contra-indicated.

CHARLES G. SUTHERLAND, M.D.

Malignant Papillary Cystadenoma in a Double Kidney. Nelse F. Ockerblad and Hjalmar E. Carlson. *Jour. Urol.*, 40, 572-576, November, 1938.

A right-sided nephrectomy was done on a white male, 25 years of age, for a malignant papillary cystadenoma in a double kidney. Twelve days following the nephrectomy, x-ray radiation was begun and 4,000 r was given to the right kidney within the next 13 days, using 200 kv.p., 0.5 mm. copper, and 1 mm. aluminum. The patient is alive and well one year after the operation.

Microscopic sections, a sketch of the kidney, and a pyelogram are included.

JOHN G. MENVILLE, M.D.

Diagnostic Problems in Surgical Kidney Disease. Maurice Muschat. *Pennsylvania Med. Jour.*, 42, 111-116, November, 1938.

A plea is made for the more extensive use of intravenous pyelography in making a differential diagnosis, and a warning is given that other abdominal conditions may simulate kidney pathology or be present at the same time.

JOSEPH T. DANZER, M.D.

Embryoma of the Kidney (Wilms' Tumor). William E. Ladd. *Ann. Surg.*, 108, 885-902, November, 1938.

This is a report of 45 cases in which pathological specimens were obtained: 44 at operation and one at autopsy.

The gross and microscopic pathologies are described and microscopic specimens are demonstrated. In diagnosis, it is stated that the average age in the series was two years and three months and that the incidence was higher in females. The diagnosis is difficult and it is stated that pyelograms, either intravenous or retrograde, may be suggestive but cannot be considered conclusive evidence of the presence or absence of embryoma of the kidney.

The author has had little experience with pre-operative irradiation but agrees that it should be used only to facilitate operation, reduce operation mortality, or prevent dissemination of the tumor. In describing the operative technic it is stated that the present incision of choice is a rectus or paramedian incision.

Post-operative reontgen therapy has been used in only the recent cases, so that an evaluation is impossible.

In the series of 45 cases, 31 have died. Of the 31, all but one had a recurrence or had died within one year of the operation. Of the 14 patients living, 11 "may be classified as probable cures," the length of time since nephrectomy varying from one and one-half to nineteen and one-half years.

JOHN G. MENVILLE, M.D.

THE KNEE JOINT

The Roentgen Image of the Joint Space at the Knee. R. Lohr and W. Hellpap. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 58, 45-56, 1938.

From a review of 642 roentgen images of knees and various experimental projections, the following conclusions are drawn in regard to the so-called joint spaces:

1. Differences in aiming of the central ray may induce a malprojection of these spaces but a difference in the width of these spaces cannot be simulated by this procedure.

2. Injuries to the collateral ligaments and unstable ("wobbly") joints often form the basis for differences in the width of the inner and outer joint space.

3. Incarcerations of, or injuries to, the semilunar disks cannot be diagnosed on the basis of the width of the joint spaces.

4. Differences in normal thickness of cartilaginous layers, and degeneration of articular cartilage, represent frequent explanations for differences in the apparent width of the joint spaces.

5. In fractures involving the articulation, the width of the joint spaces depends on the terminal relationship of articulating osseous parts.

H. A. JARRE, M.D.

THE LIVER

Hepatic Complications in Polycythemia Vera. Arthur R. Sohval. *Arch. Int. Med.*, 62, 925-945, December, 1938.

The author reports an autopsy-proven case of a 30-year-old male who had enlargement of the liver, ascites, and jaundice due to a thrombosis of the hepatic veins in polycythemia. A study of 59 other cases showed 50 per cent as having a moderate or marked enlargement of the liver. A correlation was found between the degree of enlargement and the duration of the disease, but none was noted with splenic enlargement, the blood picture, nor the intensity of the treatment. Marked enlargement of the liver frequently indicates some complicating condition such as phenylhydrazine jaundice, leukemic transformation, myocardial decompensation, hepatic cirrhosis or thrombosis of the hepatic veins.

A review of the literature on hepatic cirrhosis, and thrombosis of the hepatic and portal veins is given. It is noted that enlargement of the liver, ascites, and terminal jaundice is practically constant in thrombosis of the hepatic veins; frequent in cirrhosis, and rare in portal thrombosis. These, plus resistance of the ascites

to the mercurial diuretics, and a markedly abnormal plasma cholesterol partition, indicate the diagnosis of hepatic thrombosis in this condition.

C. W. REAVIS, M.D.

Pyogenic Liver Abscess. Eldridge L. Eliason, Robert B. Brown, and David P. Anderson. *Pennsylvania Med. Jour.*, 41, 1147-1153, September, 1938.

The incidence, etiology, and pathology of this relatively rare condition are covered briefly but well. The authors believe that roentgenological examination is the most valuable aid in the diagnosis, but positive x-ray evidence is seen in only 64 per cent of the cases. Elevation and restricted movement of the diaphragm are the most common signs. Abscesses of the left lobe and deep in the liver substance give less positive signs. According to Miles, from 2 to 20 per cent of liver abscesses occur on the concave surface and may often be diagnosed by the deformity of a barium-filled stomach.

JOSEPH T. DANZER, M.D.

THE LUNGS

Tests of Respiratory Efficiency and Their Correlation with Radiological Appearances in the Lungs. Esther M. Kíllíck. *British Jour. Radiol.*, 11, 401-404, June, 1938.

Five tests of respiratory efficiency are outlined: (1) Vital capacity of the lungs; (2) ventilation equivalent for oxygen; (3) volume of dead space; (4) mercury U-tube tests, and (5) exercise tolerance tests. The ventilation equivalent for oxygen is the volume of air breathed, which corresponds with the absorption of 100 c.c. of oxygen. The mercury U-tube test measures the expiratory force and the time the breath can be held while maintaining a steady expiratory pressure.

Even in these five tests it is very difficult to establish normal standards for there are tremendous individual variations. Tests on several workers of different ages showing different degrees of silicosis and asbestosis show no correlation between the findings on the different tests. The writer feels that the most accurate comparison can be made by making different tests on the same individual on different days. There was no correlation between the roentgen-ray appearance of the lungs in the subject and the findings of the respiratory efficiency tests.

SYDNEY J. HAWLEY, M.D.

Primary Cancer of the Lung. Donald S. King. *New England Jour. Med.*, 219, 828-833, Nov. 24, 1938.

Following a review of the early work on primary carcinoma of the lung and particularly that at the Massachusetts General Hospital, attention is directed to the rapid incidence of this condition in present-day medicine. Symptomatology includes cough, pain, weight loss, hemoptysis, dyspnea, fever, and purulent sputum. The physical findings depend upon the amount of bronchial obstruction. In the hilar type of tumor the x-ray

film shows a tumor in that location, or an atelectatic lung as a result of bronchial obstruction. The peripheral type of tumor shows a rounded or lobulated shadow separated more or less from the lung root. Pleural effusion is frequently present.

A definite diagnosis can usually be established by bronchoscopy with biopsy, by biopsy of cervical or axillary lymph nodes, and occasionally by "suction biopsy."

Prognosis is always bad. X-ray therapy gives poor results. Surgery, by early removal of the involved lobe or lung, may result in cure.

JOHN McANENY, M.D.

The Rapid Evolution of a Pulmonary Cyst with the Formation of Separated Peripheral Shadows. Brun, Jaubert De Beaujeu, and Bège. *Jour. de radiol. et d'électrol.*, 22, 495-500, October, 1938.

This is a case report of a man 58 years of age, complaining of pain in the left side of his chest. X-ray examination showed a large ovoid shadow in the left lung-field representing a fluid cyst. Re-examination three months later showed considerable increase in the size of the cyst, with the formation of multiple small, clear, crescent-shaped shadows at the periphery. Re-examination four weeks later showed considerable reduction in the size of these peripheral shadows. At operation a few days later the cyst was found to contain clear, sterile fluid.

The authors advance multiple theories of their own and others in explanation of these peculiar clear peripheral shadows or pneumocysts. They may follow injury to a fluid cyst by mechanical causes, such as coughing, trauma, exploratory puncture or rupture of a neighboring cyst, or infectious causes with perforation of an alveolus or bronchiole in the region of the cyst membrane. These pneumocysts frequently decrease in size or disappear following enlargement of the fluid cyst. Some believe that the formation of pneumocysts is accompanied by suppuration and vomiting but this has not been the experience of these authors.

Seven illustrations show clearly the evolution and disappearance of these peculiar peripheral shadows or pneumocysts.

J. SAGEL, M.D.

Acute Aerobic (Non-putrid) Abscess of the Lung. Harold Neuhoﬀ and Arthur S. W. Touroﬀ. *Surgery*, 4, 728-734, November, 1938.

The authors consider the most serious complication of acute necrosuppurative bronchopneumonia to be non-putrid pulmonary abscess formation. This is an aerobic abscess in contrast to the anaerobic putrid type commonly known and recognized.

The term "necrosuppurative" was coined because the co-existence of suppuration and necrosis characterizes the disease.

Acute aerobic abscess of the lung is no longer rare because the incidence of necrosuppurative bronchopneumonia has greatly increased. The stage of transition between necrosuppurative bronchopneumonia and

aerobic pulmonary abscess is not recognizable, clinically.

Aerobic pulmonary abscess is seen in two important forms: interstitial and segmental. The latter is the subject of the present communication. Of the two forms in which it occurs (multiple and solitary), the solitary abscess is the only one of surgical significance.

Three classes of solitary abscess are described: (1) pulmonary abscess as an incidental part of an extensive necrosuppurative bronchopneumonia; (2) pulmonary abscess within the area of pneumonia, and (3) typical abscess surrounded by a more or less sharply limited and narrow zone of infiltrated lung.

There are pathologic features which are common to all three varieties, namely, substantial size, monolocularity, superficial situation within a pulmonary lobe, overlying agglutinating pleural adhesions, and more or less extensive destruction of the bronchi.

The clinical manifestations of segmental pulmonary abscess are essentially indistinguishable from the antecedent necrosuppurative bronchopneumonia. The differentiation must be based on roentgenographic signs and findings. Pulmonary abscess must be differentiated from other pulmonary diseases, especially tuberculosis and neoplasm.

Details of the operative treatment are given; a single-stage operation is outlined. The results of operation in the three varieties of abscess (aerobic), as well as in perforated abscess, are indicated in the case reports. Operations in Classes 1 and 2 have been unsatisfactory; operation for abscess of Class 3 has in every case been followed by cure.

JOHN E. WHITELEATHER, M.D.

Occupational Diseases of the Lungs in Agricultural Workers. Richard Fawcitt. *British Jour. Radiol.*, 11, 378-392, June, 1938.

Agricultural workers are exposed to infection by organic matter, microfungi, and bacteria which exist in grasses, straw, grain, foliage, fruits, soil, and animal excreta.

The fungi which infect man belong to the hyphomycetes. They may infect the skin, bone, respiratory, and gastro-intestinal tract. No microfungus recovered from the sputum should be considered pathogenic unless it can be cultivated at 37° C. In some cases symbiosis plays an important part.

The incidence of mycotic infection of the lungs is dependent on mouldy hay or grain. The patients are usually suspected of having tuberculosis. The following types of infections are commonest: (1) in hay workers, aspergillus, penicillium, and mucor; (2) in grain workers, penicillium; (3) in stable men and gardeners, mucor; (4) in horsemen, absidia corymbifera; (5) cattlemen, monilia and actinomyces.

The symptoms are a gradually increasing dyspnea; cough with scanty sputum; slight fever, and increased sedimentation rate. The clinical signs are those of bronchitis or asthma.

The radiological appearances are: early stage—lung

markings increased and showing reticulation; second stage—soft snowflake mottling, generally distributed throughout the lungs. Mid-lung fields and bases tend to be more involved than the apices. Emphysema is common. Third stage—accentuation of second-stage findings with increased linear markings; fourth stage—coalescent areas of density, restriction of diaphragm movement, and emphysema.

The only case which has come to autopsy showed distended and ruptured alveoli, and fibrosis.

The condition responds readily to potassium iodide and creosote.

The development of disease in hayworkers is gradual, but more rapid than with inorganic dusts. Symptoms develop more quickly in grain workers. Stablemen and gardeners infected with mucor are apt to have hemoptysis and develop bronchiectasis.

Actinomycosis of the lungs may occur as a pneumonic type or as miliary abscesses. The infection tends to spread downward. Finding of actinomycosis is the deciding factor in the diagnosis since the roentgen appearances resemble tuberculosis or pneumonia.

The *Bacillus abortus* of Bang may give a picture resembling tuberculosis. Differential diagnosis is made by agglutination tests on the blood.

Pulmonary anthrax has a rapid and prostrating course. Pulmonary edema is prone to develop, usually resulting in death.

Glanders occasionally infects man, and the lung appearance is woolly with an increase in hilum shadows. Cavitation may be seen.

Hydatid cysts may show rough or multiple rounded shadows in the lung. Occasionally a fluid level will be visible within the cysts which are often hard to distinguish from benign and from malignant tumors.

SYDNEY J. HAWLEY, M.D.

PNEUMOTHORAX

The Effect of Unilateral Pneumothorax on Pre-existing Tuberculous Lesions in the Opposite Lung (A Study of 200 Cases). U. de Michelis and E. Conte. *Minerva Med.*, 1, 312-321, March 24, 1938.

After a period of observation of three months the authors draw some tentative conclusions; that, in general, bronchopneumonic types do well, but those of bronchogenic origin, particularly if advanced, do poorly.

E. T. LEDDY, M.D.

Artificial Pneumothorax in Children. P. F. Fitzpatrick. *Irish Jour. Med. Sci.*, 155, 727-729, November, 1938.

The author first describes pulmonary tuberculosis, the primary infection with its crescentic homogeneous shadow in the upper lung-field and definite lower margin, then the secondary infection or adult type is described. The chronicity of secondary tuberculosis in children is stressed, as is also the poor prognosis.

Clinical notes of two cases of artificial pneumothorax are presented, which, although they add nothing new to the study of tuberculosis, are accompanied by good roentgenographs showing the initial lesions and follow-up films showing resolution and healing.

JOHN McANENY, M.D.

Contralateral Spontaneous Pneumothorax Complicating Artificial Pneumothorax. John B. Andosca. *Am. Jour. Med. Sci.*, 196, 559-564, October, 1938.

Spontaneous pneumothorax occurring contralaterally with artificial pneumothorax is a rare happening. It is probably due to the rupture of an emphysematous bleb or a subpleural lesion. It may be of the closed, open, or valvular types, as determined by manometric readings. The signs and symptoms will depend on the rapidity of onset, size of opening, type of pneumothorax, presence of adhesions, and amount of combined collapse of both lungs.

The two patients reported, recovered from the accident because of the withdrawal of air as soon as the diagnosis was made.

BENJAMIN COPLEMAN, M.D.

THE PROSTATE

A Case of Large Opacity in the Prostate. Fr. Bernasconi, Ch. Viallet, and R. Marchioni. *Bull. et Mém. Soc. de Radiol. Méd. de France*, 26, 182-185, March, 1938.

In a case presenting symptoms of prostatism, a roentgenograph demonstrated a large bilobated mass of homogeneous density in the prostatic region. The authors believe this to represent a calcified neoplasm, as evidences of metastatic malignancy were found elsewhere.

S. R. BEATTY, M.D.

Metastases from Occult Carcinoma of the Prostate. Ormond S. Culp. *Jour. Urol.*, 40, 530-538, October, 1938.

This is a report of a minute carcinoma of the prostate with metastasis in the thoracic vertebrae. A neurologic bladder and, finally, pyelonephritis resulted in death. The clinical impression was that of a tumor of the cord. Deep x-ray therapy was started in the latter stages of the disease.

JOHN G. MENVILLE, M.D.

Sarcoma of Prostate and Adjacent Retrovesical Structures. Elmer Hess. *Jour. Urol.*, 40, 629-640, November, 1938.

This is a report of two cases of sarcoma of the prostate. The first case occurred in a boy 22 years of age. A diagnosis of prostatic abscess had been made. Following a suprapubic operation with the removal of biopsy specimen, a diagnosis of spindle-cell sarcoma was made. X-ray therapy, the amount of which was not stated, was given. The patient died three months later, and no autopsy was performed.

The second case reported was that of a boy, six years of age, presenting a mass distending the perineum, scrotum, and penis. The initial impression was: teratoma testes, tumor corpora cavernosa, and phimosis. Biopsies were made of perineal and penile swellings, and the report revealed a myxosarcoma. The patient's parents refused to let him be treated. Sixteen months later the patient was again seen and an abdominal mass was resected, together with the bladder wall. Examination of the tissue revealed a neurofibrosarcoma of the sympathetic nervous system. The patient was given an unstated amount of post-operative x-ray treatment, and was much improved nine months later.

JOHN G. MENVILLE, M.D.

RADIATION EFFECTS

The Biologic Effect of Roentgen Rays. H. Holthusen. *Strahlentherapie*, 1938, 62, 228.

After some brief historical remarks regarding the first studies of the biologic effect of roentgen rays by pioneers, as Albers-Schönberg, Bohn and Perthes, Heineke, Regaud, Försterling, Bergonié and Tribondeau, the author analyzes critically the results of more recent studies. The latent time between exposure and demonstrable effect, the time factor, the recovery rate from radiation injuries, and radiation mutations are discussed. The superiority of the "long time" method is seen in the better summation of the radiation effect in the chromatin substance, while protraction may account for the greater cumulation in radiosensitive cells.

ERNST A. POHLE, M.D., Ph.D.

Radiobiology and Radiation Therapy. A. Gunsett. *Strahlentherapie*, 1938, 62, 211.

The article represents the paper read by the author in October, 1937, in honor of the two hundredth anniversary of Galvani's birthday. The close relationship between experimental radiobiology and practical radiation therapy is logically developed from the beginning of the roentgen and radium era. Special attention is paid to the biophysical foundation of our present-day methods of administering roentgen therapy.

ERNST A. POHLE, M.D., Ph.D.

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The authors attempt to express mathematically the effect of roentgen rays on living tissue. They start out with a partial differential equation which is modified by replacing the constant by a function expressing the permeability rhythm of membranes. This is explained by experiments of some investigators which seem to indicate that the permeability of membranes are of a periodic character. Since x-rays increase the permeability of membranes and since during the presence of

the x-ray erythema this permeability reaches a maximum it is concluded that between the periodic changes of the membrane permeability and the first cycles of the x-ray erythema exists a close relationship. The authors believe that the primary effect of roentgen rays must be seen in an irreversible poisoning of the living cell.

ERNST A. POHLE, M.D., Ph.D.

RADIATION BURNS AND INJURIES

Tracheal Stenosis from Roentgen Therapy. Louis H. Clerf and F. Johnson Putney. *Ann. Otol., Rhinol., and Laryngol.*, 47, 666-669, September, 1938.

The authors report two cases in which stenosis of the lumen of the trachea appeared to follow the use of roentgen rays in the treatment of exophthalmic goiter. In one patient the treatment had been given eight years previously. Following this, dyspnea developed and gradually became so extreme as to require tracheotomy. There was an almost complete obliteration of the tracheal lumen at the level of the second ring. The other patient had been treated six years previously and shortness of breath had begun three years later. On examination there was found a stenosis of the trachea beginning at the level of the third tracheal ring and extending downward for about one centimeter. The mucosa was atrophic in appearance and exhibited small granular area, that bled readily when touched. The larynx appeared to have suffered no injury. The authors believe that these effects were due to the previous roentgen treatments. This opinion was based on the occurrence of marked telangiectasis of the skin over the irradiated areas and the presence of atrophic changes of the tracheal mucosa at the same level.

L. W. PAUL, M.D.

Several Cases of Radiodermatitis and Active Ulceration Treated and Cured by Halibut Liver Ointment. Belot, Nahan, and Marquis. *Bull. et Mém. Soc. de Radiol. Méd. de France*, 26, 158-160, March, 1938.

The analgesic, anti-infectious, and healing properties of fish liver oils of high vitamin A and D content are well illustrated by results in a series of cases of radiodermatitis and of ulcerations from other causes treated with local application of haliver oil.

S. R. BEATTY, M.D.

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Since acute x-ray reactions of the third degree are not very common to-day because of the protective measures taken, the author reports a case of this type. A young man experimented in a physics laboratory with a fluoroscopic screen, operating the tube between 15 and 43 kv. at 4 ma. by using his hand as a test object on three successive days. Each time an exposure of several seconds was done for six or seven times. Two

days after the last experiment the skin seemed somewhat red and eight days later large painful blisters developed. Ulceration developed and under proper treatment it healed within five weeks. Four months later the typical signs of chronic radiodermatitis appeared: pigmentation with atrophy of the skin, and epilation. The author concludes that this incident is due to mere carelessness and could have been avoided.

ERNST A. POHLE, M.D., Ph.D.

Therapy of X-ray Leukopenia. C. Carrié. *Strahlentherapie*, 63, 183, 1938.

Patients who are subjected to sufficiently high doses of roentgen rays develop a leukopenia. The author used vitamin C in its treatment, especially in cases that received prolonged series of irradiation. While the therapeutic effect was very satisfactory, better results were seen when vitamin C was given at the beginning of the exposures.

The advisability of administering vitamin C to individuals exposed to roentgen rays and radium professionally is also discussed.

ERNST A. POHLE, M.D., Ph.D.

Roentgen Late Injuries. F. John. *Strahlentherapie*, 63, 188, 1938.

The author relates the history of a patient, 59 years of age, who had received x-ray therapy for a probable Hodgkin's disease 21 years before. The exposed areas showed atrophy and telangiectasis of the skin. There was also spondylarthrosis deformans of the cervical spine and a calcification in the axillary area, with ulceration of the skin. It was interesting to note that in spite of the injuries of the skin and of the spine, intact sebaceous glands were found in the irradiated areas.

ERNST A. POHLE, M.D., Ph.D.

RADIUM

The Construction of Superficial Applicators for Radium Therapy. Ralston Paterson and Warwick MacVicar. *British Jour. Radiol.*, 11, 452-470, July, 1938.

Surface applications of radium have several advantages over interstitial applications: no operative procedure is necessary, no anesthetic is necessary, the patient is not necessarily confined to bed during treatment, the risk of sepsis is *nil*, transplantation of tumor tissue is avoided, the cosmetic results are usually better, as there is less tissue injury, convalescence is easier, the dosage is more accurate.

The basic principles to be observed in making applicators for surface application are as follows: the treated area must extend well wide of the obviously involved area; applicators must allow accurate placing, and accurate maintainance of distance between radium and the lesion; they must be easy to place in position, and must stay there when placed, and the radium must be held securely in the mould so that it will not be lost or misplaced. It is obvious that an individual applicator must be made for each case.

The article describes in detail how to take impressions and how to mix and mould various substances in making surface applicators.

S. J. HAWLEY, M.D.

Therapy with Radio-active Emanation. H. Hirschi and H. Bodmer. *Schweiz. med. Wehnschr.*, 68, 404-407, April 16, 1938.

In the first part, Hirschi points out that the alarm felt over the dangers of emanotherapy is based on ignorance or neglect of two very important factors, dosage and form. If the dosage is not kept to safe levels, injuries will occur as a matter of course. The form of radio-active material used must have a short life, and for this reason one is practically limited to radon. With proper dosage, injury has not been observed in his hands in the last 20 years, although thousands of cases have been treated.

In the second part, Bodmer points out that radon therapy does not fall in the general condemnation of parenteral therapy with radio-active substances. The method has been used in true gout, chronic rheumatic diseases, neuralgia, myalgia, etc. Emanation therapy is a non-specific modality, with reversible effects. The point of attack is the cell. The effects may be observed through skin absorption, breathing, or drinking the active substance. Dosage in the range of 10 millistats may be effective. The theory of action is not well known; some of the theories are mentioned. Effects on the blood, sedimentation rate, the liver, and the endocrines are noted. Alterations in the acid-base equilibrium of the blood are reported, as well as in the alveolar CO₂ tension. Rajewsky has shown that 1 μ gm. Ra equivalent is a dangerous dose.

LEWIS G. JACOBS, M.D.

Radium Therapy of Hemangiomas. W. Baensch. *Strahlentherapie*, 63, 496, 1938.

The author treated large cavernous hemangiomas by implantation of radium needles using 1, 2, and 4 mg. radium element per needle in 2.5, 3, and 4.5 cm. length, filtered through platinum-iridium. The best results were obtained if 1 mg. of radium per c.c. of tissue was applied and left *in situ* for 48 hours. A second treatment is not given before two or three months have elapsed. There was no bleeding and no necrosis when properly distributed. The results in a high percentage of 230 cases treated in this manner were excellent.

ERNST A. POHLE, M.D., Ph.D.

Is it Possible to Use a Radium Bomb for Intravaginal Treatment of Carcinoma of the Uterus and would it be Possible to Improve Considerably the Distribution of Radiation? R. du Mesnil de Rochemont. *Strahlentherapie*, 63, 465, 1938.

The usual methods of intra-uterine radium application have the great disadvantage that there is a rapid drop of the radiant energy from the applicator surface to the depth. Consequently, only a small limited volume

The second case reported was that of a boy, six years of age, presenting a mass distending the perineum, scrotum, and penis. The initial impression was: teratoma testes, tumor corpora cavernosa, and phimosis. Biopsies were made of perineal and penile swellings, and the report revealed a myxosarcoma. The patient's parents refused to let him be treated. Sixteen months later the patient was again seen and an abdominal mass was resected, together with the bladder wall. Examination of the tissue revealed a neurofibrosarcoma of the sympathetic nervous system. The patient was given an unstated amount of post-operative x-ray treatment, and was much improved nine months later.

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the presence of silicosis should be definitely established. The roentgenogram is of paramount importance. After the presence of silicosis is established the patient is advised of his condition and one of two decisions has to be made. First, it must be decided whether or not the patient is fit to work. If possible, the worker is given employment in a risk-free job. Some prefer to work on as long as possible. Occasionally other conditions, such as cardiac disease, are found to account for the disability. The decision of what is the best disposal of the case is often very difficult. The second question to be decided is the prognosis, which is always difficult, due to the sudden intervention of chest infections. Every silicotic should be regarded as a potential tuberculous patient.

S. J. HAWLEY, M.D.

THE SPINE

Calcification of the Meniscus and Hypertrophic Spurring. Roederer, Gaucher, and Jésover. Bull. et mém. Soc. de Radiol. méd. de France, 26, 225, 226, April, 1938.

The authors describe a case with flattening of the eleventh dorsal vertebra with calcification in two parts in the meniscus between it and the tenth dorsal. There was also hypertrophic bridging between these vertebral bodies. The region had been painful for over a year and was tender to percussion. They ascribe these changes to an old gonorrhea.

S. R. BEATTY, M.D.

Anomalies of the Vertebral Articular Apophyses. F. Willemin and M. Cantagrill. Jour. de radiol. et d'électrol., 22, 490-494, October, 1938.

The authors point out the difficulty of diagnosis of spinal films due to their complex morphology and due to general lack of knowledge of the normal appearance except in the anteroposterior and lateral views. The importance of the oblique views is emphasized, especially when the diagnosis is not apparent from the routine films. A good knowledge of osteology is necessary for the correct interpretation of these oblique films. The medico-legal factor is also important in this consideration.

The case presentation is that of a man 28 years of age, who complained of pain in the right lumbar region radiating down the posterior surface of the thigh in the manner of sciatic neuritis. Films made in the routine anteroposterior and lateral positions show accessory apophyses of both inferior articular processes of the third lumbar vertebra and of the left one of the second lumbar vertebra, indicating congenital anomalies. These are especially well shown in the oblique views which permit good detailed study and lead to the conclusion that this congenital anomaly is not the cause of the patient's complaints.

The condition must be differentiated from apophyseal fractures which are exceedingly rare and initiated

by trauma. The differential diagnosis is difficult but can usually be made by a study of films made in several positions, including the oblique ones.

The most common location of this anomaly is in the second and third lumbar vertebrae. The origin of these anomalous apophyses is assumed to be supernumerary nodules arising from abnormal centers of ossification. Trauma is not a factor but simply leads to x-ray examination of the lumbar spine with consequent discovery of the condition. It is uncommon but not rare, as one would be led to believe from a review of the French literature. It does not of itself produce pain or other subjective symptoms but may co-exist with other pathologic conditions. This latter statement is, I believe, the authors' most important contribution.

J. SAGEL, M.D.

Vertebral Osteo-arthritis Due to *Brucella melitensis*. H. Duclos. Bull. et mém. Soc. Radiol. Méd de France, 26, 10, 11, January, 1938.

The recognition of vertebral involvement due to *Brucella melitensis* has become more frequent. A case of vertebral osteo-arthritis with loss of the disc between lumbar vertebrae seven and four, in a man of 50 years of age who had suffered from Malta fever three years before, is presented.

S. R. BEATTY, M.D.

Remarks on a Vertebral Cancer. F.-G. Marill, R. Raynaud, and André Huguenin. Bull. et Mém. Soc. de Radiol. Méd. de France, 26, 170-174, March, 1938.

Postmortem examination of a spine involved by metastatic carcinoma confirms previous findings. Extensive involvement of the body of a vertebra may exist without crushing or deformity of the body, the disc is seldom involved, roentgenographs of the spine *en face* do not reveal involvement of the vertebra as do profile views, roentgenographs of the spine of the living individual fail to show as extensive involvement as do roentgenographs of the spine after dissection, and finally roentgenographs do not always reveal lesions already of considerable size.

S. R. BEATTY, M.D.

SYPHILIS

Luetic Osteitis Simulating Malignant Disease. A. H. Ungerman, W. H. Vicary, and W. W. Eldridge. Am. Jour. Roentgenol. and Rad. Ther., 40, 224-229, August, 1938.

Roentgenographically, a marked similarity may be present between periosteal syphilis and periosteal sarcoma. The authors state that it is characteristic in syphilis that bone production exceeds bone destruction and sarcoma shows a rapidly destructive process with little effort at repair. The periosteal proliferation in sarcoma is in the nature of an irritative reaction with new bone striæ, perpendicular to the axis of the shaft.

In syphilis the new bone formation is more laminated, the lamination lying parallel to the shaft and tending to unite with it at the margins of the process. Cases in which a definite diagnosis cannot be made should be given a therapeutic anti-syphilitic test before more radical procedures are done. A detailed case report with illustrations is given.

IRVING I. COWAN, M.D.

Roentgenological Manifestations in Bone Syphilis. Dudley Marcus Stewart. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 215-223, August, 1938.

The author gives a complete classification of the different types of bone and joint lesions in congenital and in acquired syphilis. The roentgen findings in congenital syphilis are characteristic and the differentiation from changes seen in rickets and scurvy is clearly made.

Many adults with acquired syphilis will have characteristic roentgen changes in the bones and joints with negative serological findings. The commonest skeletal lesion in acquired syphilis particularly in the period of latency, is a typical periosteal proliferation of the more or less lacy type, depending on the duration of the disease. Syphilitic osteitis in the earlier stage in younger individuals is usually manifested by atrophic changes; in later stages, in older individuals, this manifestation is hypertrophic. Syphilitic osteitis and gumma may resemble chronic suppurative infections but the accompanying periostitis of characteristic type is diagnostically important.

The trophic joint changes of the Charcot type are manifestations of the tertiary stages of syphilis of the dorsal columns of the spinal cord.

The osseous lesion in yaws and the trophic changes in syringomyelia are closely related to those in syphilis, and should be carefully differentiated.

IRVING I. COWAN, M.D.

TUBERCULOSIS, PULMONARY

The Diagnosis and Management of Latent, Suspected, and Early Clinical Tuberculosis. H. W. Hetherington. *Jour. Am. Med. Assn.*, 109, 1952-1955, Dec. 11, 1937.

Modern methods of tuberculosis case finding employing the tuberculin test and x-ray examination have modified our conception of the early diagnosis and have presented the general practitioner with a new problem, namely, the management of apparently healthy persons who present evidence of tuberculous lesions on x-ray examination. These cases are discovered in one of two ways; either through examination of contacts of known tuberculous patients, or in tuberculosis surveys of groups of apparently healthy persons such as high school and college students, pupil nurses, and industrial employees. Occasionally cases are found by accident when x-ray examination is made with some other purpose in mind than the discovery of a tuberculous lesion.

X-ray examination of all contacts, or at least of con-

tacts giving a positive reaction to tuberculin, should be made whenever possible. Fluoroscopy, if available, affords an inexpensive diagnostic aid. When contact is with sputum-positive tuberculosis, the interval between examinations should be three months or less. If sputum is not positive, from three to six months is an appropriate interval. Periodic examinations should continue after contact is finally broken. If x-ray examination is available, two years of observation is sufficient, but if physical examination must be relied upon, periodic examinations should be made for at least five years.

CHARLES G. SUTHERLAND, M.D.

Direct Roentgen Therapy through Small Fields of Pulmonary Tuberculosis. G. Faldella. *Minerva Med.*, 1, 337-340, March 24, 1938.

After eight months' experience in Bacmeister's Clinic, the author feels that x-rays should be used more often in treating pulmonary tuberculosis because the results are so favorable, particularly if used with other forms of sanitarium treatment.

E. T. LEDDY, M.D.

Radiological Disappearance of Cavities Immediately Following Phrenico-exeresis and Their Re-appearance after a Variable Lapse of Time. V. Basunti. *Riv. di Pat. e Clin. d. Tuberc.*, 12, 404-418, June, 1938.

The author reports three cases of pulmonary tuberculosis, presenting all the clinical signs of cavities, sputum positive for Koch's bacillus, and radiological evidence of cavities in the right upper lobe. Treated by phrenico-exeresis the clinical signs disappeared, the sputum became negative, and the cavities could not be shown roentgenologically shortly after the operation. Following a variable period of time, however, all the signs reappeared.

The writer discusses at length the mechanism leading to the healing of cavities and the influence that phrenico-exeresis bears on the process.

It is the author's opinion that we are due for a revision of our opinion as to the ultimate results after phrenico-exeresis.

A. MAYORAL, M.D.

The Roentgenography of Pulmonary Tuberculosis. Hollis E. Potter. *Minnesota Med.*, 21, 763-768, November, 1938.

The author stresses the need for recognition, on the part of medical men in general, of the early roentgen signs of pulmonary tuberculosis. The parenchymal lesions can be identified in about 95 per cent of the cases. He uses the term "tuberculoid" in describing some of the lesions, leaving the question of whether or not they are "tuberculous"—or active—to the result of clinical observation.

The architectural pattern of the lesions tends to conform to the mechanics of whatever portion of the

lung is invaded—whether a whole lobe, a sub-lobar division, a single lobule, or a single acinus.

Four main types of infection are recognized.

1. *Simple or exudative type* resembling pneumonia on the film. It is overshadowed by a diffuse homogeneous exudate, the so-called peri-focal reaction or collateral inflammation. At a later period the films show its true character by a small mottled and nodular residue after resorption of the reactive exudate.

2. *The exudative-productive type* is also relatively benign. Its scattered lesions for a time show a melted homogeneous appearance at the periphery, as from peri-focal exudate, but later, upon clearing, a more resistant nodular central zone appears which remains for some time before complete healing. These productive or proliferative features distinguish it from the exudative type. Upon complete healing it leaves but slight scar, either linear or nodular. In these simple forms the intensity of the process does not reach the stage of real necrosis and cavity formation.

3. Much more serious is the third type, often called *the caseous-pneumonic type*. In this type more or less massive necrosis does occur and if the patient survives the first onslaught, caseation, liquefaction, evacuation, and cavitation follow in due order. The caseation and cavitation in these types result sometimes in a condition of lifelong disability seen in those sub-types known as chronic ulcerative and chronic fibro-ulcerative tuberculosis. These cavity cases fill our sanatoria and clinics, and call for mechanical and surgical handling.

4. The fourth general type is known as *chronic proliferative tuberculosis* and is the result of a lengthy series of super-infecting doses over a long period, seldom accompanied by any show of peri-focal exudate and mainly visible in the form of discrete nodular or linear scars. Starting often in the apex, the lowermost lesions may show diffuse borders corresponding to their more recent origin.

Cavities larger than a cherry seldom heal spontaneously.

Occasionally, a caseous lymph gland ulcerates into a bronchus, being one of the causes of a positive sputum in the absence of x-ray findings.

PERCY J. DELANO, M.D.

The Spontaneous Cure of Some Forms of Pulmonary Tuberculosis. O. Maestri. *Minerva Med.*, 1, 299-312, March 24, 1938.

The author reports ten cases of pulmonary tuberculosis cured by sanitarium treatment for at least three years, and discusses the roentgenologic changes noted in these patients.

E. T. LEDDY, M.D.

Correlation of the Positive Reaction to Tuberculin and the Shape of the Chest. S. A. Weisman. *Jour. Am. Med. Assn.*, 109, 1445, 1446, Oct. 30, 1937.

This study, which shows that there is a definite correlation between the deep chest and the positive reaction

to tuberculin, supports the contention that the deep chest is more or less associated with tuberculosis. It helps to explain why there is such a high incidence of tuberculosis among the poor in the slum districts. The children in the slums are physically under-developed. They are not only shorter and lighter but they have on the average a deep, primitive, infantile type of chest, one that has not gone through the normal process of development. Even the new-born and infants are shorter and lighter and have a deeper chest than the average infant from a better environment.

Changes in environment, the result of slum clearance, should result in a marked decrease in the incidence of pulmonary tuberculosis.

CHARLES G. SUTHERLAND, M.D.

TUMORS (DIAGNOSIS)

Primary Tumors of the Duodenum and the Jejunum and Lymphogranuloma of the Duodenum. Manlio Cace. *Radiol. Med.*, 25, 365-384, April, 1938.

Cace takes advantage of a limited series of tumors of the duodenum and jejunum, as well as one of carcinoma of the ampulla of Vater, to present the radiological findings as they appear in the individual segments. The writer makes a gratifying trial at the differential diagnosis. The presentation of the individual cases is unusually thorough. The findings have been confirmed by autopsy or during operation in all but one patient, who refused operation.

The rarity of the condition is brought out by the author when he refers to 500,000 autopsies, reported by others, in which the percentage of duodenal tumors amounted to 0.3 per cent, and of jejunal tumors to 1.1 per cent.

The location and nature of the six tumors presented are as follows: two adenocarcinomas of the duodenum; one lymphogranuloma of the duodenum; one malignant growth in the ampulla of Vater, suggestive of an adenocarcinoma, and a medullary epithelioma of the jejunum.

Roentgenologically, primary tumors of the duodenum can be diagnosed by the stenoses they cause, accompanied by loss of the mucosal pattern, elasticity of the intestinal wall, and of the intestinal peristalsis.

More or less widespread stenosis may present very irregular walls or extensive ulceration. Duodeno-biliary fistula is at times a complication.

The author believes that the characteristic sign of tumors of the ampulla of Vater is a flame-like shadow seen at the level of the ampulla itself.

The signs of growths in the jejunum are also due to obstruction and are revealed roentgenologically by gas in the segments of the intestines, proximal to the obstruction, better shown when the roentgenographs are made with the patient in the erect position; marked slowing of the opaque fecal column, and alterations of the mucosal pattern.

The article is, I believe, excellent and highly instructive. To do it full justice it should be read in the original.

ANTONIO MAYORAL, M.D.

TUMORS (THERAPY)

Pedunculated Cancer of the Pylorus. Poirier and Lamoureaux. *Bull. et mém. Soc. de Radiol. méd. de France*, 26, 276-279, April, 1938.

The roentgenographic, operative, and microscopic findings of a tumor attached to the pyloric region by a peduncle and filling the bulb are given. The tumor was composed of cells of mixed types.

S. R. BEATTY, M.D.

Irradiation of Cutaneous Manifestations of Lymphoblastoma. Robert G. Pett. *Pennsylvania Med. Jour.*, 42, 387-391, January, 1939.

Under the term "lymphoblastoma," the author includes Hodgkin's disease, myelogenous and lymphatic leukemia, lymphosarcoma, and mycosis fungoides.

Cutaneous manifestations occur in about 10 per cent of the cases, either as metastatic infiltration, petechiae with metastatic infiltration, or exfoliative dermatitis.

The treatment may be local, consisting of low voltage unfiltered rays to the areas involved, giving from 80 to 160 r to each port at weekly intervals. The factors used are 200 kv., 0.5 mm. Cu and 2 mm. Al, 40 to 50 cm. distance, from 100 to 300 r per port.

Care should be exercised in cases in which there is a generalized adenopathy or a high white count.

JOSEPH T. DANZER, M.D.

A Case of Melanoma. M. Arnaud. *Bull. et mém. Soc. de Radiol. Méd. de France*, 26, 78, January, 1938.

Roentgen therapy proved effective in preventing dissemination of metastatic melanoma of the axilla and in causing primary disappearance, although a large axillary mass was removed a year and a half later.

S. R. BEATTY, M.D.

THE UTERUS

Cancer of the Cervix: Therapeutic and Biological Thoughts. S. Laborde. *Strahlentherapie*, 63, 658, 1938.

This paper is based on an analysis of 813 cases of carcinoma of the cervix examined and 592 treated during the period of 1921-1932. The results are compiled in eight tables. It appears that at the end of five years 57.5 per cent of 40 patients in Group I, 48.9 per cent of 92 patients of Group II, 31.6 per cent of 284 patients of Group III, and only 4.5 per cent of 176 patients of Group IV were alive and free from recurrence. This would give an average percentage of 28.2 for all four

groups. The technic for both radium and roentgen application is described. The paper concludes with a discussion of the etiology of cancer of the cervix and suggestions for a more efficient fight against cancer.

ERNST A. POHLE, M.D., Ph.D.

Results in the Treatment of Carcinoma of the Cervix at the Women's Clinic of the University of Göttingen from 1926 to 1937. F. Erichsen. *Strahlentherapie*, 63, 426, 1938.

At the author's clinic patients with carcinoma of the cervix in good general condition and early lesions are operated upon (radical vaginal extirpation) and the others are irradiated (combination of x-rays and radium). In recent years the "intravaginal roentgen therapy" with special body-cavity tubes has been used and the improvement in results, particularly in the advanced cases, is probably due to this new technic. A statistical survey of the author's material showed that of 342 cases with carcinoma of the cervix, 120, or 35 per cent, were still well and free from recurrence. Interesting is the comparison of 80 operable cases, 46 of which (or 57.5 per cent) were well at the end of five years. Twenty-four, or 58.7 per cent, had been saved by operation and 22, or 57.8 per cent, by irradiation.

ERNST A. POHLE, M.D., Ph.D.

WARTS

Plantar Wart. Walter Kelton. *Northwest Med.*, 37, 299, September, 1938.

Kelton reports a case of plantar wart of nine years' duration. Following various treatments, including radium and deep roentgen therapy, it was excised. The last paragraph of the article, which I quote, I believe to be of interest to radiologists: "The ulcer is now healed, but there is a large amount of painful scar tissue, the result of operating in a field where tissue has been cooked and blood supply destroyed by radium."

A. MAYORAL, M.D.

Treatment of Plantar Warts: Clinical Memorandum. H. Haldin-Davis. *British Med. Jour.*, p. 18, July 2, 1938.

The author in discussing surgical technic is highly enthusiastic over the use of x-radiation in loosening the wart from its bed. Surgical procedure consists of a curettement of the remaining softened tissue. The analgesic effect of x-ray is also noted.

Q. B. CORAY, M.D.



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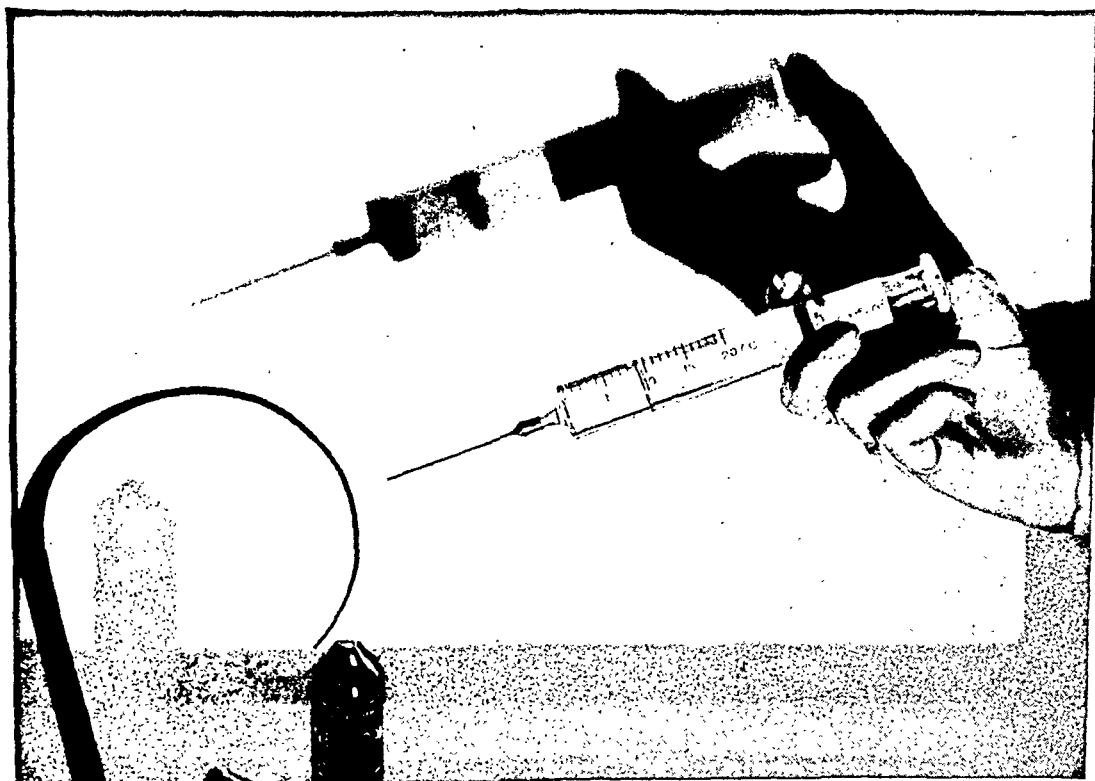
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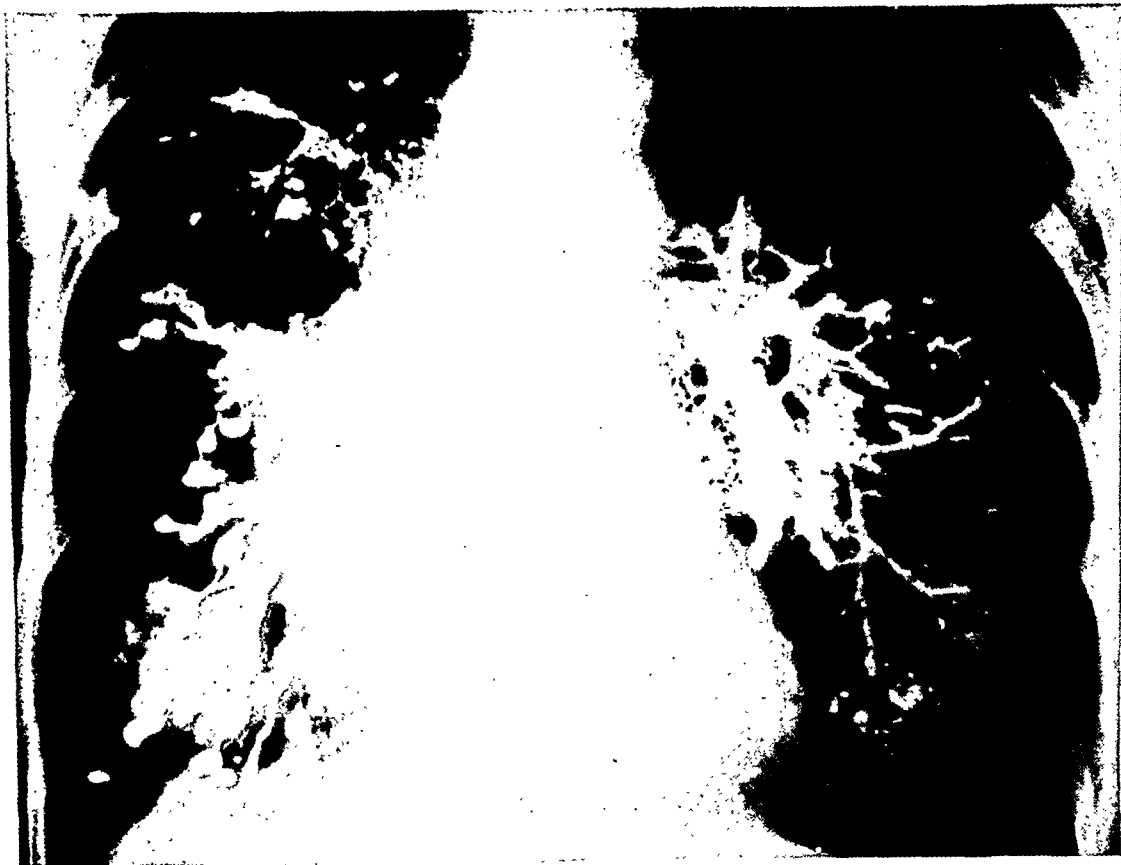
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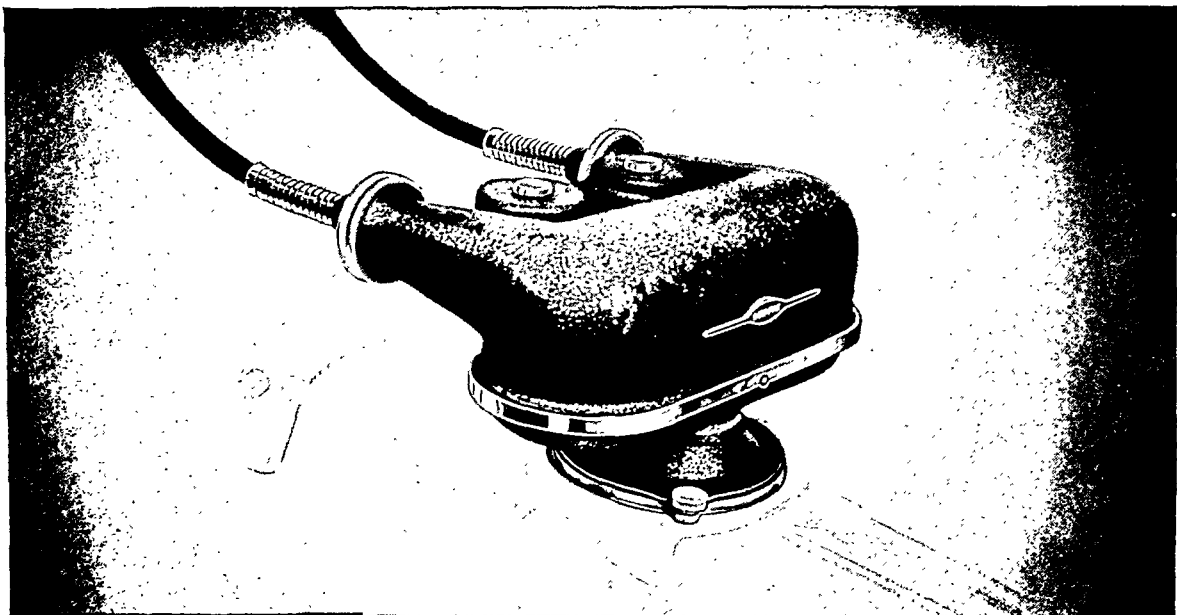
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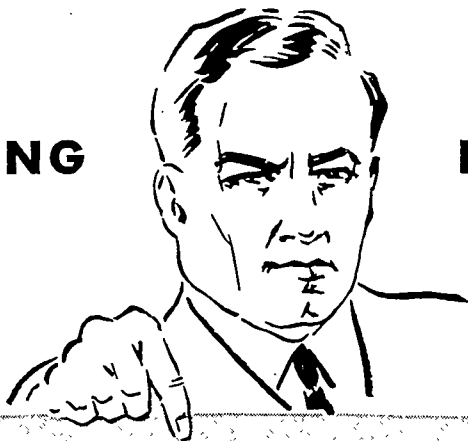
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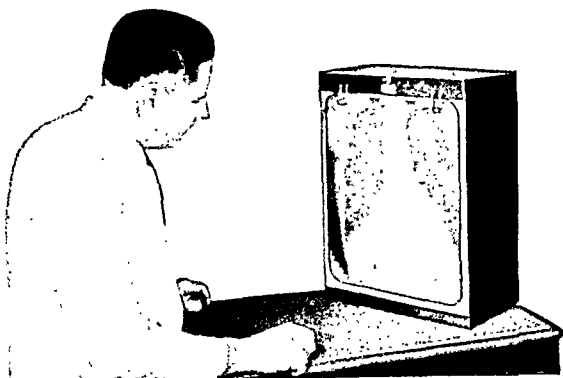
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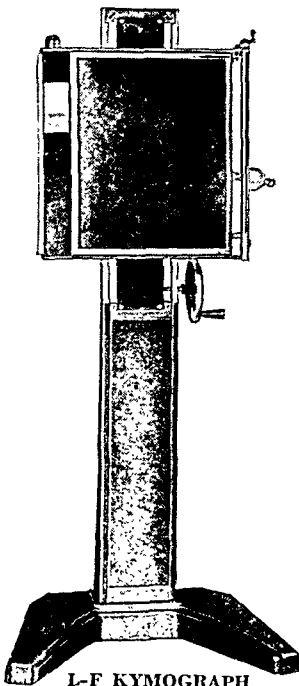
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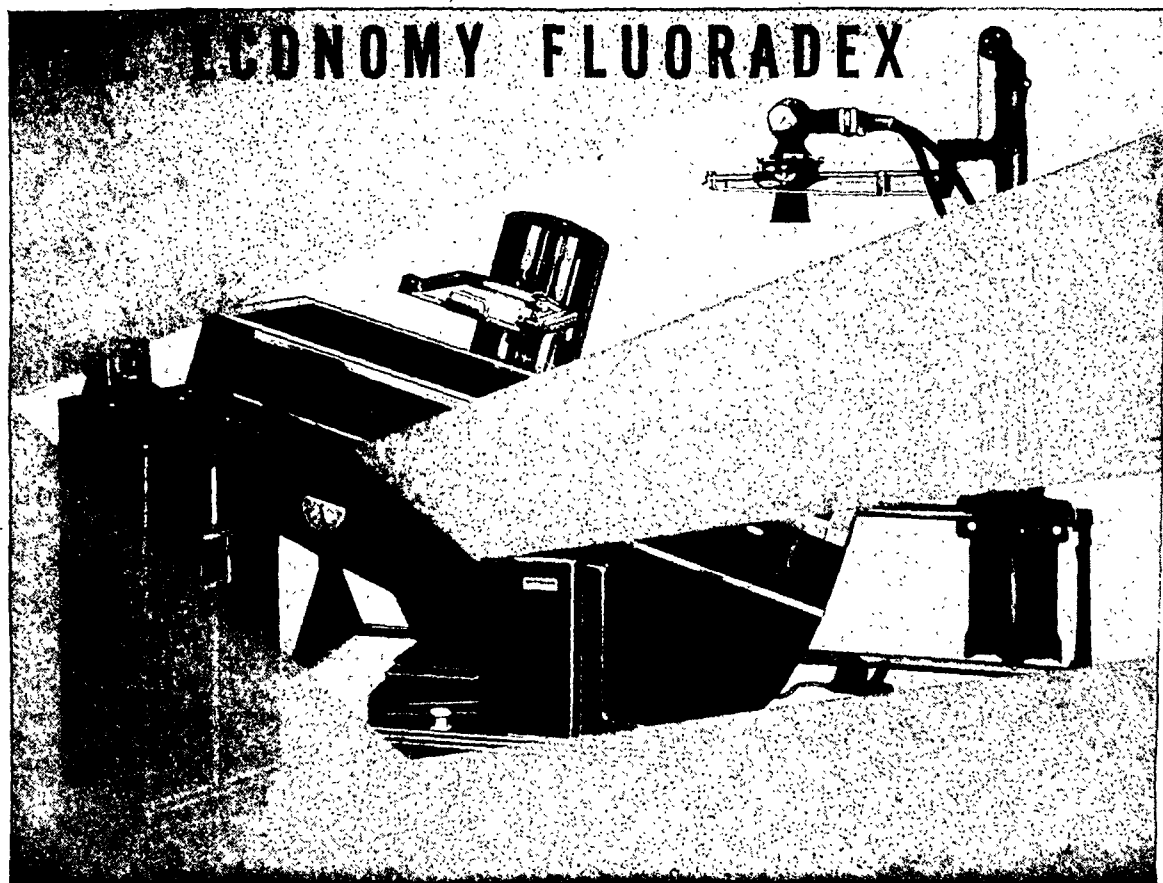
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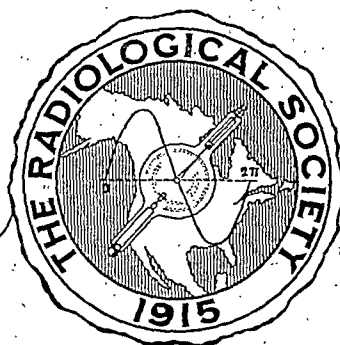
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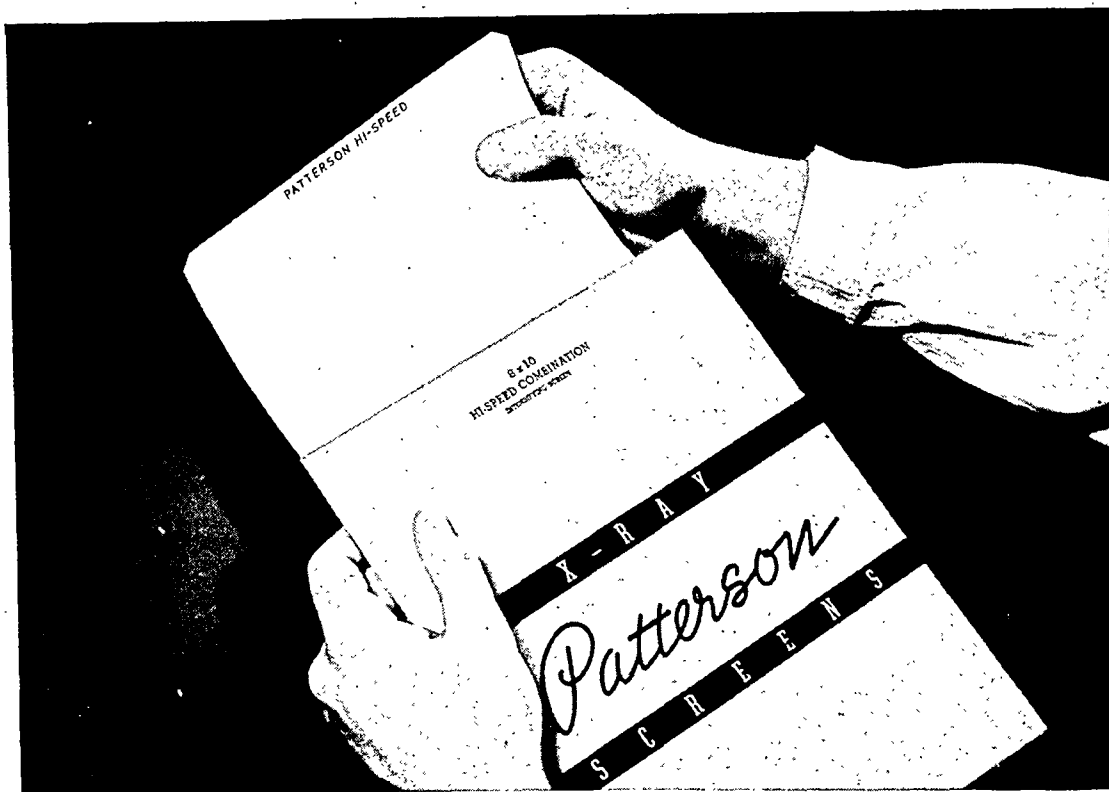


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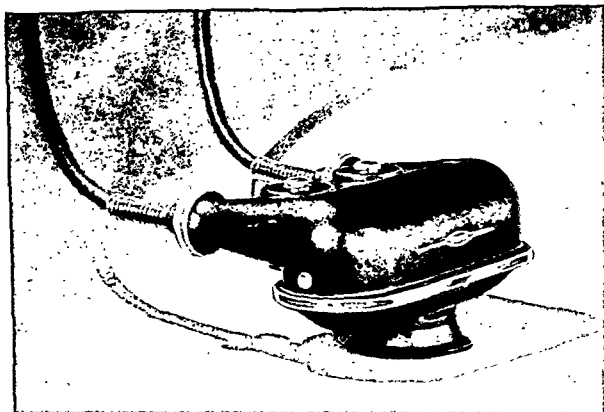
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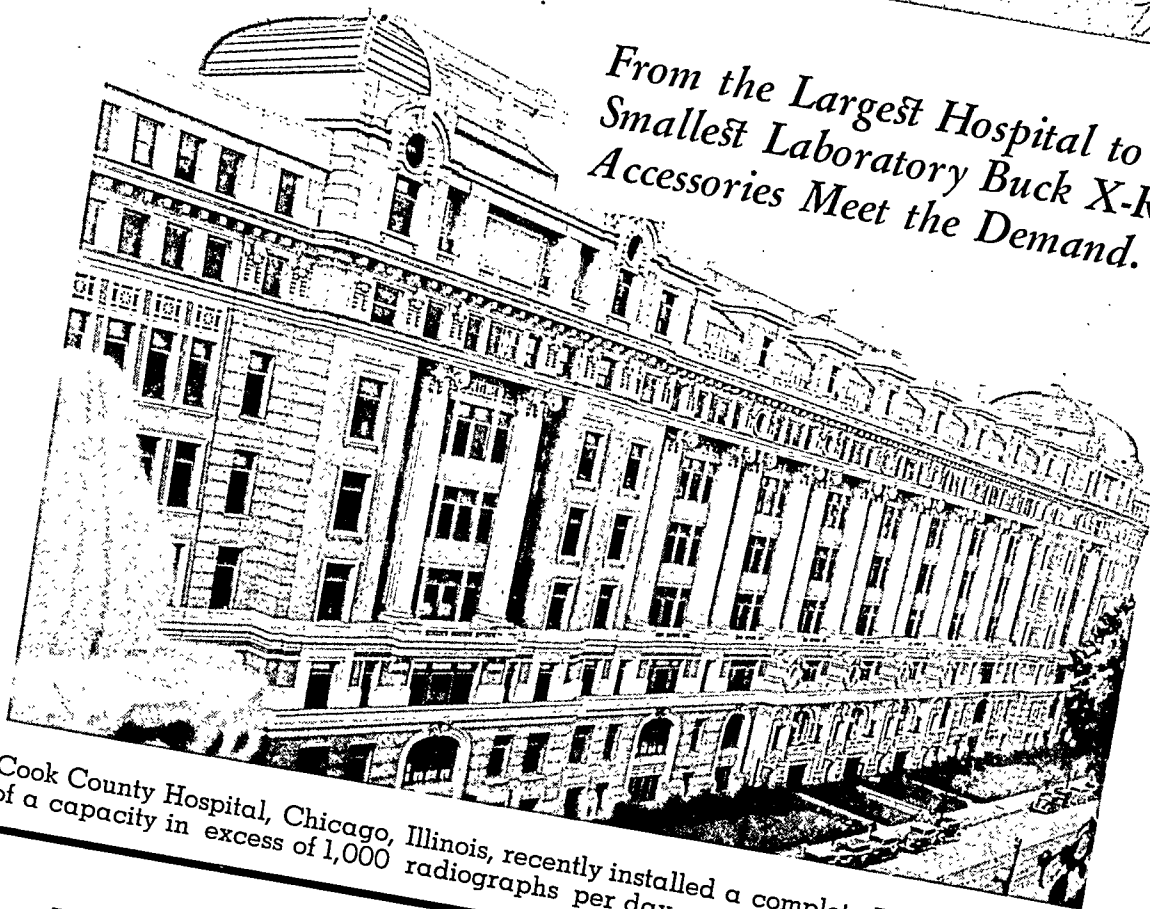
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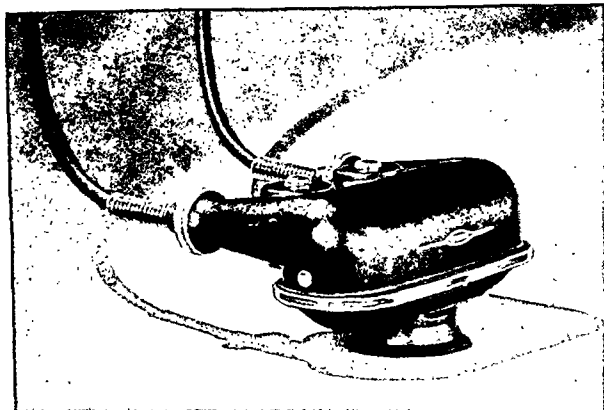


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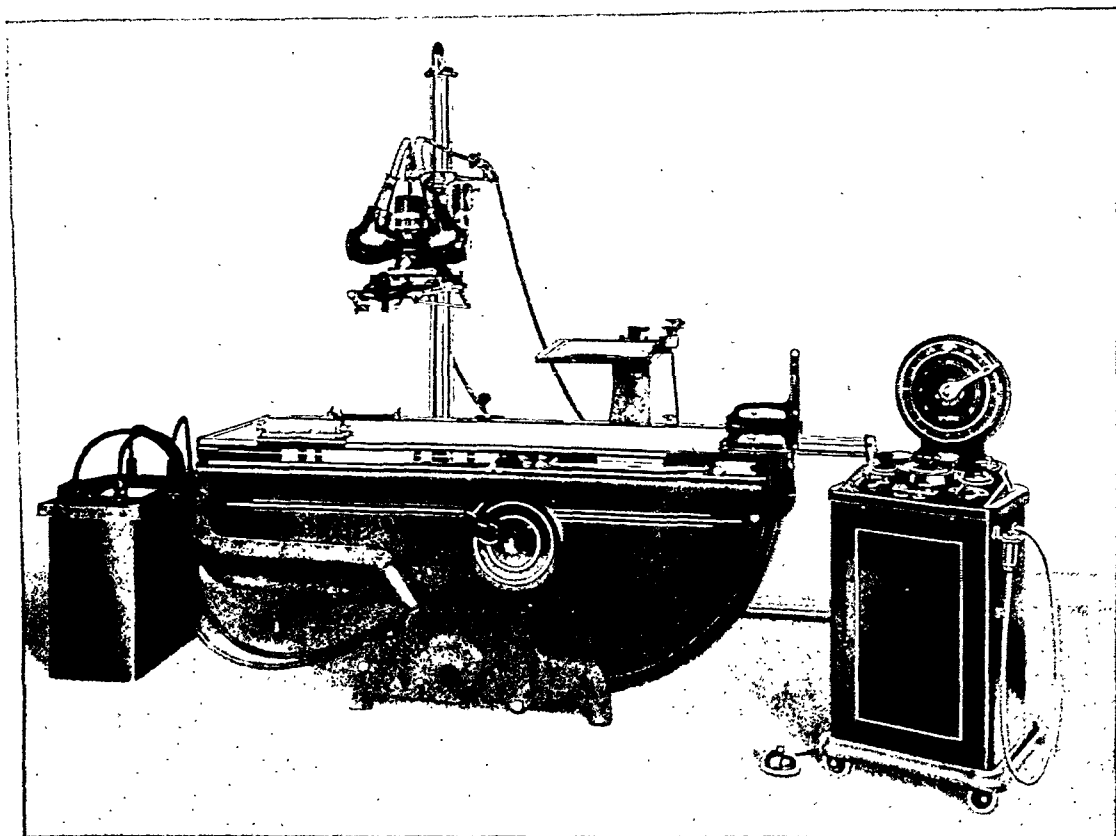
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THE BONE CHANGES IN PRIMARY HYPOGONADISM¹

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THIS report is based on observations made on nine cases of primary prepuberal hypogonadism. By this term we refer to that condition in which puberty has not taken place (absence of secondary sex characteristics), in which there is every evidence clinically of normal pituitary function, and in which there is no evidence of other endocrine disorders.

When the usual and normal physiologic changes caused by a particular gland fail to appear, it is, therefore, natural to assume that the gland is deficient. It must not be forgotten, however, that such changes are produced not only by the activity of the hormone in question but also by the ability of the end organ to react to that hormone. Furthermore, if there is evidence of activity of a certain gland, as determined by biological tests which even now are relatively crude, the product of that gland may fail to produce a reaction in the end organ because the hormone may be present in an inactive form.

A clear conception of these principles should simplify diagnosis of endocrine disorders. It is our belief that most endocrine disorders are primarily uniglandular in origin, and that many of the so-called pluriglandular syndromes will eventually be regarded as originating in one endocrine gland.

Deficient sex secretion causes different clinical pictures, depending on the time of life at which it occurs. Excluding pituitary disease, hypogonadism may be classified in relation to time of life, as follows: (1) Loss or failure of sex hormone to be secreted in infancy or childhood up to the usual time of puberty. This failure is followed by typical prepuberal or primary hypogonadism. (2) Loss or failure of gonadal secretion to act shortly after puberty. This may result in partial development of secondary sex characteristics and epiphyseal closure, although they may be delayed (Case 5). (3) Loss of gonadal secretions after epiphyseal closure. In this case there may be slight regression of sex characteristics or they may remain unchanged (Case 6, Fig. 1). The gain in weight so often ascribed to the termination of sex secretion, especially at the menopause, may be due to the loss of the special effect of sex hormone which produces that dynamic or energizing difference between a sexed and an unsexed person.

Apparently the true sex hormones of the gonads bring about epiphyseal closure, at least this phenomenon is closely associated with sex maturity. Longitudinal growth at the usual time of puberty cannot be attributed to sex hormones since it continues when these hormones are absent. Thus, open epiphyses are present in true primary hypogonadism and growth continues. This combination is practically pathognomonic

¹ Read before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

of primary hypogonadism, providing growth does not proceed at an abnormal rate. Growth of long bones continues, resulting in time in disproportionate measurements, the span equalling and oc-

of the acidophilic tumor, thus preventing epiphyseal closure.

In a roentgenologic study of the bone in these cases of primary hypogonadism we have noted in addition to the recognized



Fig. 1.



Fig. 2.

Fig. 1. Case 6. Essentially normal hand in case of premature menopause.

Fig. 2. Secondary hypogonadism occurring in case of gigantism due to pituitary tumor in a male, aged 16 years. Note practically same bony changes except for tufting of distal phalanges. Bones also are proportionally over-size (length as well as width).

casionally markedly exceeding the height. In the true hypogonad giant, growth does not proceed at an abnormal rate but only for an abnormal time. This is to be noted in contrast to the true pituitary giant. In one of our cases of pituitary gigantism the epiphyses remained open (Fig. 2). Puberty did not occur and growth continued at an abnormal rate due to an acidophilic pituitary adenoma. In this case had sex hormones been present, epiphyseal closure should have taken place, further longitudinal growth would have ceased, and acromegaly followed if the pituitary adenoma had remained over-active. Since such cases are almost always due to tumor, it is presumed that the sex-secreting cells, basophilic, are crowded out by the growth

delayed epiphyseal closure an unusual bony structure. The changes found which we consider to be characteristic of primary prepuberal hypogonadism may be listed as follows in the order of their importance: (1) A tendency to longer bone growth; (2) delayed epiphyseal closure; (3) subcalcification; (4) thinning of cortical layer; (5) thin-walled, normal-sized trabeculation, and (6) roughening of metaphyseal margin of growing bone. It is likely that these changes may not be present in later decades of life as there is evidence in most cases of some gonad secretion, which, over a long period of time, brings about closure of epiphyses. Case 4 represents probably the greatest degree of gonad deficiency, almost approaching a true absence of sex

secretion, or agonadism. Dental caries has been noted in our cases, an observation mentioned by Englebach.

In this report we have included seven cases of typical primary prepuberal hypo-

believe, are characteristic of hypogonadism.

Case 6 was selected to show the lack of change in a woman of the same age, with a postpuberal hypogonadism. Actually, this

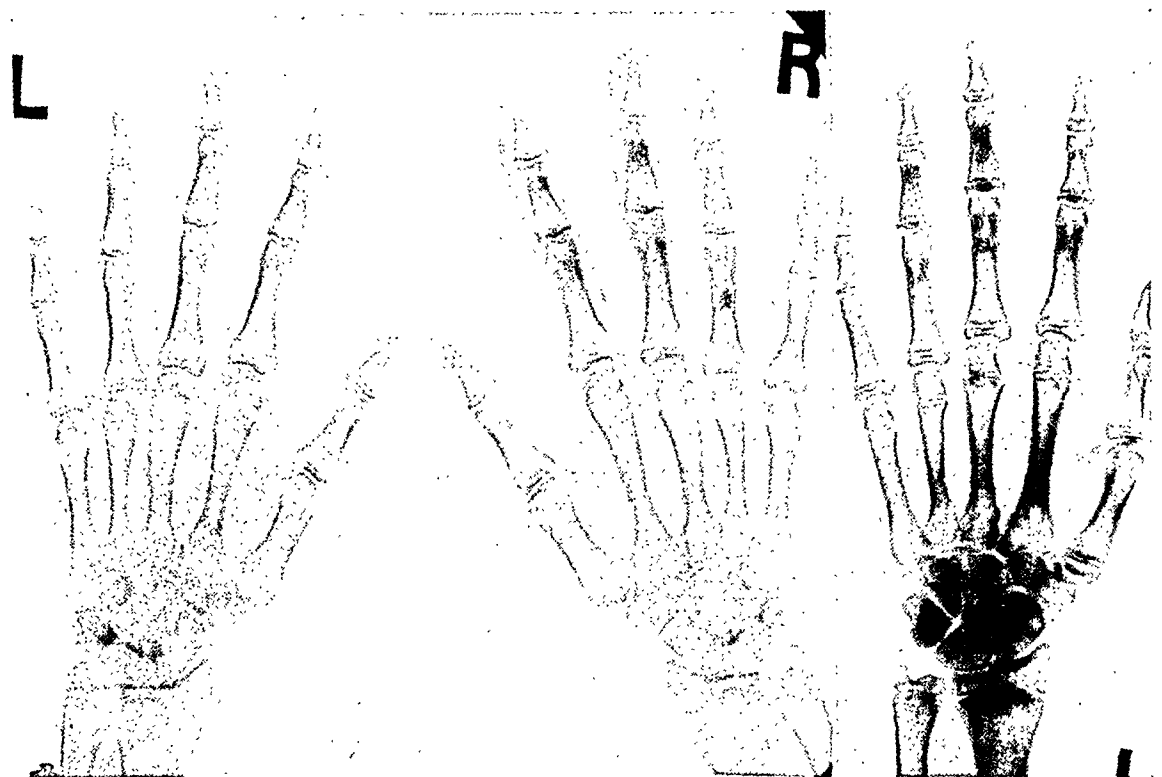


Fig. 3-A.

Fig. 3-B.

Figs. 3-A and 3-B. Cases 1, 2, and 3. Primary prepuberal hypogonadism in females aged 18, 29, and 55 years, respectively. (See Figure 3-C.) Typical bone changes are shown. Note subcalcification, open epiphyses, thin cortical layer and thin-walled normal sized trabeculations, and length of metacarpals and phalanges.

gonadism, four males and three females. We have also, by way of comparison, added two cases of postpuberal hypogonadism in young women.

Case 1 is typical of primary hypogonadism in a woman 29 years of age (see résumé of individual cases). Roentgenograms of the hands of this patient are shown in Figure 3. The long, tapering hand is well demonstrated, along with open epiphyses. We desire to call attention especially to the subcalcification, thinning of the cortex of the phalanges, thin-walled, normal-sized trabeculation, and roughening of the metaphyseal margins. These changes, we

is an unusually premature menopause. No abnormality is to be seen unless the epiphyseal line, usually not visible, is to be considered evidence of retarded closure. This patient menstruated between the ages of 12 and 14 years, during which time sufficient sex hormone was available to produce mature secondary sex development and normal bone growth. Urine assay showed positive prolactin and negative estrogenic reaction in mice, typical of menopause.

Case 2 (Fig. 3), a girl 20 years of age, shows all the characteristic findings of hypogonadism. This patient had never menstruated and clinically was a typi-

cal prepuberal case. Curiously, three assays of urine and one of the blood for prolactin gave negative results, and two assays of urine and one of the blood for estrogenic factors gave 1 to 2+ reaction,

Case 3 (Fig. 3) illustrates another typical case in a woman 55 years of age. Even in well-marked hypogonad cases, epiphyseal closure will take place in time, usually after thirty, and this was true of this wo-

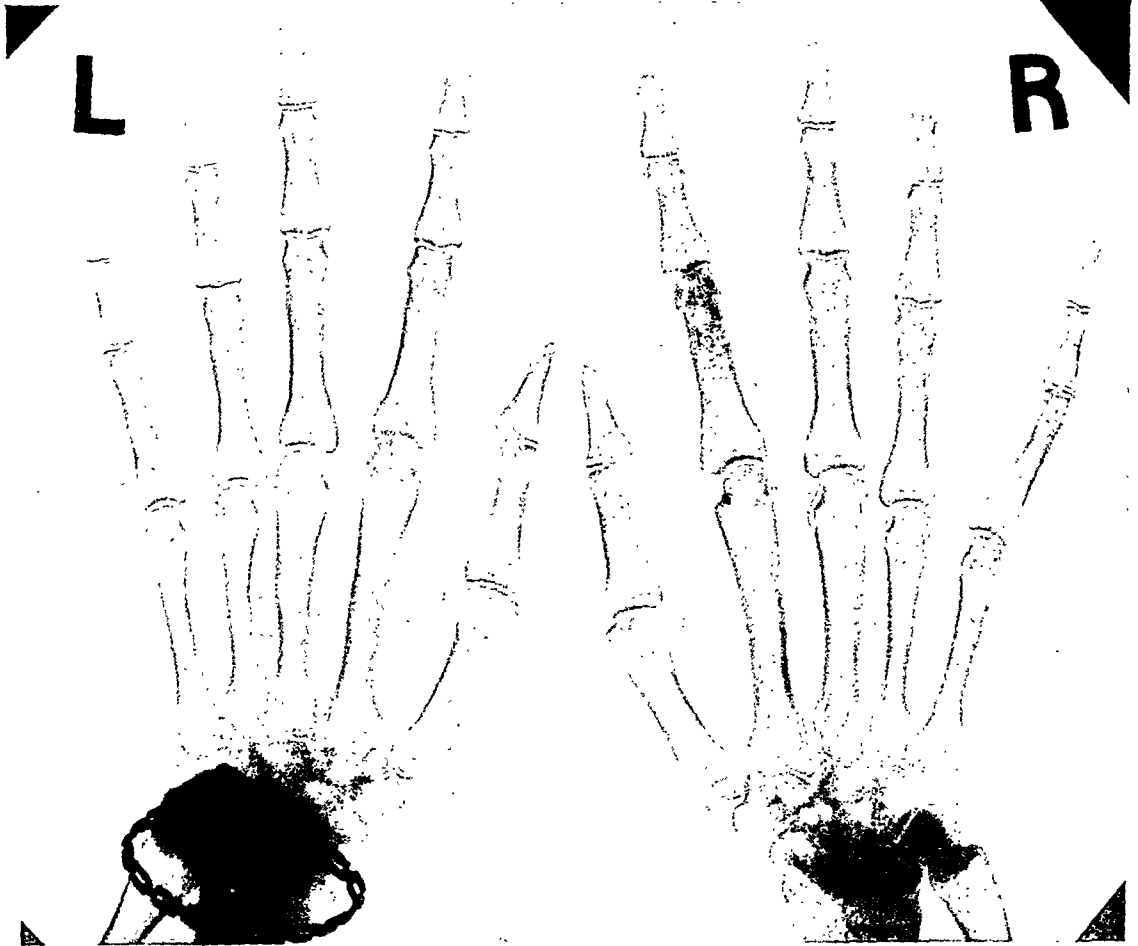


Fig. 3-C. See caption under previous cut.

which would suggest ovarian activity. This finding of estrogenic substances emphasizes the importance of bearing in mind what has previously been stated, namely, that it matters little how much hormone may be present in the body if the organ on which it acts is incapable of reacting or if the hormone is imperfect and incapable of stimulating the end organ. This would appear to be true here. It is also possible that there may be ovarian secretion in an inactive form resulting in clinical hypogonadism in the presence of active ovaries.

man. However, inspection of the scapula showed open epiphyses. In this case, too, there was marked decalcification, resulting in compression of the dorsal vertebræ of the spinal column. The other characteristic changes may be seen in the phalanges.

Case 7 (Fig. 4) illustrates the same changes in a male aged 20 years.

Case 8, a man of 60, showed no characteristic bone changes in spite of being clinically a case of hypogonadism. In this case there may have been sufficient sex hormone to have gradually brought about

epiphyseal closure although clinically he showed no secondary sex characteristics.

We have under observation at the present time a boy, ten years of age, whose testes are undescended. Exploration some years ago revealed no trace of testicular tissue. Clinically, he is as yet not physiologically hypogonad, and roentgenologic changes are not apparent. It is doubtful if they can be illustrated or expected until a year or more after puberty should have taken place.

DISCUSSION

We believe typical and well-marked primary prepuberal hypogonadism may show characteristic bony changes aside from the recognized delayed epiphyseal closure and elongated bone. These changes may be differentiated from other endocrine bone changes such as those seen in pituitary acromegaly and gigantism, prepuberal myxedema, and prepuberal pituitary dwarfism or infantilism.

REPORT OF CASES

Case 1. A female, aged 29 years; weight, 140 pounds; height, $69\frac{1}{2}$ inches; span, $68\frac{1}{2}$ inches; pubis to floor, 36 inches. The breasts were flat, and pubic and axillary hair very scanty. She had long legs and arms. She had never menstruated and said that for the past four or five years she had grown two or more inches. Prolan in the urine was in excess; examination for estrin gave negative results.

Roentgenologic examination revealed that the skull was normal. The sinuses were moderately well developed. There was marked dental caries. The long bones were increased in length and all epiphyses were still open except in the feet. There was subcalcification, thin-walled, normal-sized trabeculation, and roughened metaphyseal margins. Apophyses of the vertebrae and pelvic bones remained open.

Case 2. A female, age 20 years; weight, 103 pounds; height, $68\frac{1}{4}$ inches; span, $70\frac{1}{4}$ inches; pubis to floor, 36 inches. Eighteen months later the height was 69 inches; span, $70\frac{1}{2}$ inches, and weight, 154

pounds. She had never menstruated. The breasts were undeveloped and the amount of pubic and axillary hair was subnormal. The uterus was found, on rectal examination to be very small. The upper teeth



Fig. 4. Case 7. Primary prepuberal hypogonadism in a male aged 21 years. Note same changes as in females.

were out because of early decay. Examination of the urine revealed estrogenic factors, 2+ on one occasion and 1+ on two other occasions. The blood estrin was 2+ on one occasion. Tests three times a week for prolان in the urine were negative, and examination of the blood for prolان was positive on one occasion.

Roentgenologic examination revealed that the sinuses were well developed. A slight spongy appearance of the cranial vault was observed. The epiphyses in the hands were open. All the long bones, the pelvis, and knees showed poor calcium content but normal, thin-walled trabeculations. The knee and femoral epiphyses

were open and there was no apophyseal development of the crest of the ilium.

Case 3. A female, aged 55 years; weight, 125 pounds; height, 67 $\frac{1}{4}$ inches; span, 78 inches; pubis to floor, 38 inches. The breasts were under-developed, and pubic hair was very scanty. Kyphoscoliosis was observed. The pelvic organs were not felt by rectal examination. She had never menstruated, and complained of weakness and easy fatigability. She was placed on a low, measured calcium diet, and urinary excretion was determined. There was no excess calcium excretion. Blood calcium was 9.8 mg. per 100 c.c.; blood phosphorus, 4.4, and phosphatase, 2.11 Bodansky units. The basal metabolic rate was -3. Examination of the urine for prolan gave negative results.

On roentgenologic examination the sinuses were found to be well developed. The skull was normal. Many of the lower teeth were out. Bones of the hands and feet were long. Epiphyses of the long bones were closed, but epiphyseal line remained. There were nutritional bands in the tibia. The cortex of the bone was thin, the trabeculations sharp and well defined. The calcium content was markedly decreased, resulting in compression of the vertebræ of the dorsal spine. Apophysis of the scapula remained open. No hypertrophic changes were seen.

Case 4. This patient was an unmarried girl of 19 years, showing characteristic changes of primary hypogonadism. She weighed 137 pounds, her height was 67 $\frac{7}{8}$ inches; span, 69 inches. Axillary hair was scanty. She had a moderate amount of pubic hair. The uterus was not felt; the cervix was infantile. The teeth were in good condition. Roentgenograms showed long fingers, open epiphyses, subcalcification, thinning of the cortex, and the other changes found in cases of hypogonadism.

Case 5. A female, aged 18 years, had scanty pubic hair and under-developed breasts, and was thin. No measurements were taken, but she was not disproportionate. She had menstruated for two years and then stopped. She had a colloid goiter. Prolan in the urine was graded 2+;

examination for estrin gave negative results. Roentgenologic examination revealed that the skull was normal. The epiphyses were closed and there were no bony changes. This is a case of postpuberal hypogonadism or premature menopause.

Case 6. A woman, aged 29 years, had developed normally with well-marked secondary sex characteristics. Her height was 58 $\frac{1}{4}$ inches; weight, 170 $\frac{3}{4}$ pounds. She menstruated from the ages of 12 to 14 years, but never since then. The uterus could not be felt by rectal examination. Libido was excessive. Examination of the urine for prolan gave positive results and for estrin, negative results. Roentgenograms showed the epiphyses closed but the epiphyseal line remained visible. There were no other changes. This is a case of postpuberal hypogonadism or premature menopause.

Case 7. A man, aged 21 years, was a typical case of hypogonadism. The voice was high-pitched: he had no beard: female skin and contour. The penis and testes were very small and there was a small amount of fine pubic hair. Libido was absent. The patient was introverted and depressed. Measurements were not taken at this time, but the lower extremities were long, the hands and fingers were long and tapering. The bones showed subcalcification, trabeculations were finer than normal; the cortex was thin, and metaphyseal margins of growing bone were roughened. In November, 1938, the patient was 73 $\frac{1}{2}$ inches tall and weighed 196 pounds: his span was 76 inches.

Case 8. A man, aged 60 years, weighed 147 pounds: height was 70 $\frac{1}{4}$ inches. The voice was high-pitched, the skin lined and wrinkled, and he had female contours. The penis was very small, and the testes were the size of beans. The prostate gland was barely palpable. This patient was seen only once and further studies were not possible. Roentgenologic examination showed no hypertrophic changes and no changes characteristic of hypogonadism.

Case 9. A man, aged 30 years, illus-

trated typical hypogonadism. He weighed 201 pounds; height was 70 inches; span, $69\frac{3}{16}$ inches; pubis to floor, $37\frac{1}{2}$ inches. The penis was very small, and the testes were the size of peanuts. Pubic hair was scanty. He had been sickly until he was five years of age. He had had an occasional erection, but never seminal emission. He was not overweight until he was 20 years old, when he began to eat large amounts of sweets.

Roentgenologic examination revealed the following: the cranial vault was of average thickness without localized changes: the sella was normal: the sinuses were exceptionally well developed: the teeth showed advanced dental caries: the long bones apparently were not elongated: epiphyses were open in the ulna, radius, femur, tibia, humerus, and fibula: metacarpal epiphyses were closed. No apparent decalcification was observed, although the cortex was thin. Trabeculations were normal.

Case 10. A man, aged 24 years, weighed 172 pounds; height, $72\frac{1}{8}$ inches; span, $78\frac{5}{8}$ inches; pubis to floor, $39\frac{1}{4}$ inches. The skin was fine and slightly wrinkled around the eyes. Dental caries was present. The voice was high-pitched. His hair was graying. No beard or secondary sex characteristics were observed. The penis and testes were small. The patient married while he was under observation and claimed libido was normal and that he had erections. He received injections of male sex hormone three times a week for about four months and thought there was increase of hair on the mons pubis, but this was doubtful. Roentgenologic examination revealed that the sinuses were well developed. The skull did not reveal any abnormality.

Case 11. A man, aged 21 years, was tall and had feminine contours. He weighed 167 pounds: height was 72 inches. The beard was absent, the voice adolescent, penis small, and testes undescended. He had flat feet. The skull and sella turcica appeared to be normal on roentgenologic examination. Roentgenograms of the wrist showed that the ulna and radial epiphyses were open. The bones appeared decalcified,

with thin cortex and fine, thin-walled trabeculations.

DISCUSSION

CARLETON B. PEIRCE, M.D. (Royal Victoria Hospital, Montreal, P.Q., Canada): I am very much honored to be asked to open the discussion on Dr. Hare and Dr. Hurxthal's paper, and, as a mere radiologist, to consider the biochemical and endocrine problems of the syndrome which Dr. Hare has presented.

As radiologists, we are all familiar with the problem of determination of some correlation between the physiologic or skeletal age of individuals and their chronologic age. Extensive studies have attempted to establish for us normal base-lines for various growth periods.

Dr. Hurxthal and Dr. Hare are now calling our attention to a syndrome well beyond the margins of the normal, and have led us into the field of the hormonal control of growth about which our colleagues, the biochemists and endocrinologists, have dug out much information in the past few years. However, theory still remains as the basis of much of our current concept of the inter-relation of the ductless glands, their products, and their effect on the life of the individual.

As regards the sexual and skeletal development, so far as our present state of knowledge goes, the pituitary must be regarded as the central control, or so it seems to me and to my colleagues with whom I have discussed the matter since receiving Dr. Hare's paper. By some means it acts as a control catalyst for the hormonal products of the gonads, thyroid, and adrenals, especially.

So far as I can find out, there have been no known hypophysectomized animals in which epiphyseal closure could be induced by administration of estrin. As a corollary, Gardner and Pfeiffer, working in Allen's laboratory, have recently reported on a series of mice, not hypophysectomized but given very large doses of estradiol benzoate weekly up to a period of 348 days. These animals showed an

formation nearly or completely replacing the marrow of the femur and the other bones (except the pubis at the symphysis, which is known to undergo bone resorption in the presence of administration of large amounts of estrin).

These animals further presented an early closure of certain epiphyseal growth zones which are commonly late or incomplete in closure in mice. Those of you who have worked with these experimental animals, I think, are aware of the fact that many of the epiphyses in mice and rats close quite late in the period of growth or may never close. These men also obtained a similar effect with testosterone.

Furthermore, the hypophysectomized animals, so far as we know, will not develop a normal uterus or mammae upon the administration of doses of sex hormones. I have asked Dr. Hare this morning how we could be sure that the pituitary was quite normal in his patients. Of course, in this whole problem, one still has to depend upon really very indefinite clinical means of measurement and a certain amount of biological assay.

As to the presence or absence of demonstrable gonadal tissue, it has been established pretty thoroughly that both androgens and estrogens may be elaborated by extra-gonadal tissues—the adrenals, for instance.

In regard to the possibility that the sexual hormonal elements are present in an unused or unstable state in the circulation such is still possible—and a theory which Dr. Hare has offered for consideration. It is quite probable that these glucuronides may be synthesized by the gonadal tissues or may be conjugated elsewhere, such as in the liver, but that the enzyme which may be necessary for their activation at the epiphyseal growth zones, in the skin or the developing secondary appendages of the skin, etc., may be absent at the time or point desired, so that the development does not pursue its normal course.

Again, we cannot be sure that this may not be due to a deficiency in the catalyst

of the somatotrophic factor from the pituitary. So far, there is very little factual knowledge in regard to this latter.

The thought occurred to me while studying Dr. Hare's paper that possibly this may again be linked up with the "x" factor which we have been considering in the development of carcinoma. The question recurs as to why certain individuals who are subjected to irritation, to trauma, or to other "causative" factors, do not develop carcinoma, while others do. If we can look upon carcinoma as the result of a lack of a control factor in the tissue itself, it may be that all this is tied in together.

I have already asked Dr. Hare this morning, and I would like to ask him again, to tell us how frequently, and at what periods, the assays in regard to the prolactin and estrin were carried out. The reason I ask is that there is a feeling among endocrinologists and biochemists that the discharge of prolactin or estrin is largely a discard, an indication of unused material, and is not an indication of the total which is actually available for the individual.

In regard to the thinness of the cortex, I have been very much interested recently in following the work of Mortimer in which he has demonstrated rather thoroughly—at least to my satisfaction—that in the hypophysectomized individual (the experimental animal) there is a very definite thinning of the cortex, with a thin calvarium and a relative non-development of the frontal sinuses. That seems to be sufficiently positive to permit us at the present time, on examining human individuals, to regard such changes as indicative of some pituitary disorder.

I appreciate very much this privilege, and I feel that Dr. Hare and Dr. Hurxthal have presented to us a group which certainly we should study and investigate further. Perhaps this syndrome may explain some of the discrepancies between the chronologic age and the physiologic or skeletal age as we have been trying to establish them.

DR. HARE (*closing*): I wish to thank Dr. Peirce for being so considerate in his discussion. I realize that there may be room for some doubt as to whether this disorder is primarily of gonad or pituitary origin. While we feel that it is primarily gonad, we realize it cannot be definitely stated at the present time. In determining whether to call this disorder hypogonadism it was necessary to review our files, studying roentgenograms of pituitary or other endocrine disturbances for comparison. In the days of the Turkish harem, at which time hypogonadism was frequent, these individuals showed physical changes such as were present in our cases. These were produced by surgical removal of the gonads.

As far as the biological tests are concerned, in some cases only one assay of the urine was made; in other cases four or five assays of blood and urine were done. The assays were done only in the female patients. The most frequent finding, of course, was the presence of prolan and the absence of estrin, but there were several

patients in another group who displayed more than the usual amount of estrin found in normal women and no prolan. In both cases the clinical evidences of hypogonadism were definitely present. It seems to us that if the disorder were primarily pituitary deficiency, neither of these substances would show up in the urine or blood.

In presenting this paper I hope that we may be able to recognize this disorder, because early treatment now is very promising, especially in the male.

I overlooked the first four cases which came through the clinic. The diagnosis was brought to my attention by Dr. Hurxthal, who is interested in this group, and since then in five cases I have been able to make the diagnosis from the roentgenograms alone. It is of help to the patients to know exactly what the situation is because many of them are discouraged and, when it is once explained to them, at least they have a clearer insight into the future.

PHYSICAL MEASUREMENTS ON ROENTGEN RADIATION FROM A TUBE ACTUATED BY A VAN DE GRAAF GENERATOR

By J. CRAMER HUDSON, PH.D., *Boston, Massachusetts*

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AS a source of potential for the production of supervoltage x-rays, a Van de Graaf generator has been in use at the Collis P. Huntington Memorial Hospital for some months, and the present paper is a report of some of the measurements made on the radiation secured from a roentgen tube actuated by this generator. A description of the machine itself has been given previously (4, 12) and need not be repeated in detail. The roentgen tube is in a vertical position with the water-cooled target at ground potential. Originally, the target was a lead-plated sheet of copper inclined at about 38° to the horizontal so that radiation could be examined in the vertical direction, that is, at an angle of 0° with the electron beam, or in the horizontal direction at an angle of 90° with the electron beam. This arrangement was soon modified, however, by replacing the 38° lead target by a gold-plated horizontal target so that at present only the vertical radiation is available for experimental purposes.

The method of measuring the voltage, as has been described previously (12), consists in measuring the current through a high resistance in parallel with the tube. This resistance had been calibrated at low voltages and also at higher voltages with spark gap and generating voltmeter. For short runs this was quite satisfactory, but with prolonged running there was apparently an increase in voltage, though the x-ray output remained constant. This indicated a decrease in value of the high resistance in parallel with the tube. Therefore, a corona meter was installed as a check on the constancy of voltage and all voltage determinations were made with the high resistance before any prolonged running. As a further check on output, a parallel-plate ionization chamber was con-

nected to the input of a direct current amplifier and the output read on a five micro-ampere meter. This apparatus was made by Mr. B. J. Cosman. The ionization chamber is placed permanently in the x-ray beam and serves merely as an indicator of constancy of x-ray output.

By carefully maintaining the corona meter current, x-ray tube current, and x-ray output meter reading constant, one can secure a very stable and satisfactory source of radiation. Of course, maintaining any two of these readings constant should be sufficient, but three serve as a better check. Maintaining the x-ray output meter constant is by no means sufficient, since a decrease in voltage may be compensated for by a higher current. Consequently, during physical measurements the voltage was determined at the very beginning of the run by means of the current through the high resistance and then kept as nearly constant as possible by reading the corona current, tube current, and x-ray output. The voltage measurements are considered accurate to ± 2 per cent.

The first measurements were made on the radiation in the horizontal direction, that is, at an angle of 90° to the direction of the electron beam. For this purpose a large parallel-plate ionization chamber was constructed, in which the plates were one meter square, and their separation could be varied up to a maximum of 30 cm. A section of the lower plate, 5×15 cm., was insulated and served as the collector electrode. The longer dimension of this plate was perpendicular to the direction of the radiation. Saturation voltage for 30 cm. separation was found to be 4,000 volts, and during measurements a potential difference of 12,000 volts was maintained between the two ionization chamber plates.

The target of the x-ray tube is surrounded by three inches of lead, and an opening one inch square allowed the rays to pass through this surrounding lead shield. Pin-hole photographs of the target indicated a focal spot of about two and one-half centimeters in diameter. The x-ray beam was collimated by suitable openings in lead blocks 10 cm. thick, the first of which was placed against the lead shield of the tube and contained an opening 1.0×2.5 cm. Other collimating slits could be placed at various distances between source and collecting electrode—a distance of 180 cm.

The ionization current was read in the x-ray control room on a sensitive galvanometer connected between the collector electrode and the ground. A cylindrical lead shutter 8 cm. thick was mounted on a horizontal axis and a suitable slot cut along a radius from the periphery to about one-half the length of the radius. This slot could be moved to the horizontal position, allowing the radiation to pass, or placed vertically, thereby shutting off the radiation from the ionization chamber. This shutter was motor-driven and was controlled from the x-ray control room.

For measuring the penetration of the radiation in various materials, a filter carrier was arranged in such a way that a remote control switch allowed the insertion of various thicknesses of suitable materials in the x-ray beam. In order to avoid as far as possible scatter from the filter material itself, the filter carrier was placed as near as was feasible to the source of x-rays, and the x-ray beam was kept fairly small in cross-sectional area. In the horizontal direction, the beam which entered the ionization chamber was 3×6 cm., with the filter 150 cm. from the chamber. In the vertical direction, the beam at the ionization chamber was 8×10 cm. and the filter was 75 cm. distant from the chamber.

The purpose of the large ionization chamber was to study first the quality of the radiation, and then, at various voltages, compare the readings of the large chamber with those of a small air-wall

thimble chamber. Only a small part of this program was carried out before a change in the form of target necessitated abandoning experimentation on the horizontal radiation.

For the radiation parallel to the electron beam, the large air chamber cannot be used, and so a small, thin-walled bakelite chamber was constructed and connected to the input of a direct current amplifier and the output of the amplifier was read on a short period galvanometer.

For intensity measurements in roentgens per minute, two Victoreen condenser r meters were used—one reading 25 r full scale and the other 100 r full scale. They agreed within an experimental error of ± 2 per cent. For absorption measurements, all the chambers agreed satisfactorily in that they gave consistent values of the absorption coefficient under like conditions of voltage and filtration. This might be expected since the determination of absorption coefficients involves the ratio of readings taken on the same instrument and over a limited wave length. However, for intensity measurements in roentgens per minute, neither the large air chamber nor the bakelite thimble chamber agreed with the r meters, but one would not expect agreement at high voltages since the bakelite chamber is constructed of thin "non-air wall" material. Other workers (5, 6, 8, 10) have shown that highly penetrating radiation readings, by means of open air chambers of the size used here, do not agree with those of thimble chambers. The question then arises as to how far one is justified in assuming that the readings of the r meters may be taken as correct. One of these instruments was checked previously (9) with radiation up to 400 kv. by comparison with an effect of radiation on chromosomes. The production of chromosome abnormalities in root tip cells due to radiation was the effect studied, and the percentage of normal anaphase chromosomes, three hours after irradiation, was the criterion for dosage determination. It was found previously that the readings of the r meter

agreed well with the dose as determined by the percentage of normal anaphases for the radiation from 120 to 400 kv. The same

within an experimental error of ± 5 per cent.¹

The first target used for physical meas-

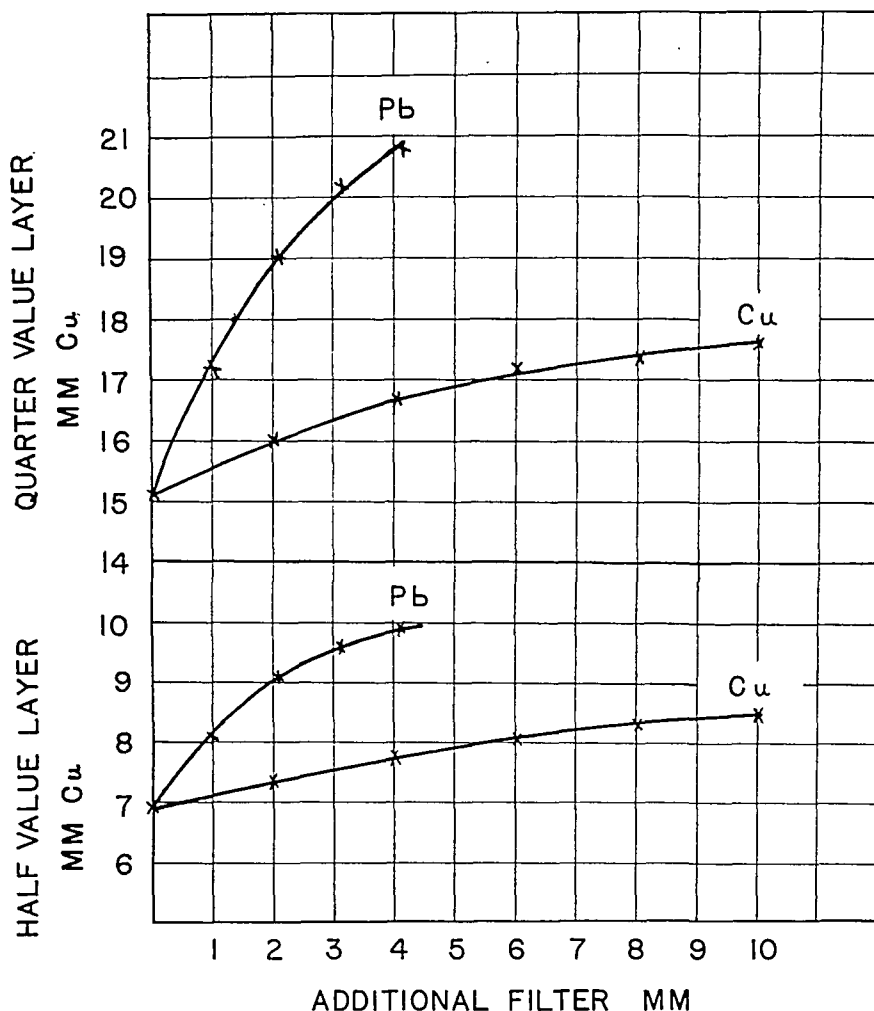


Fig. 1. Half and quarter value layers in millimeters of copper for various added filters of copper and lead; 1,000 kv. radiation normal to the direction of the electron beam. Initial filter, 5.2 mm. Cu.

comparison was made at 1,000 kv. and again the readings of the Victoreen r meter agreed, within an experimental error of 5 per cent, with the dose as determined from the curve relating percentage of normal anaphases and dose in roentgens. These determinations were made in air, without back-scatter, and under these conditions it is believed the r meters may be used to read roentgens correctly for 1,000 kv. radiation

urements consisted of lead plated on $1/16$ -inch copper and this was cooled by water which flowed in a sheet $1/16$ inch thick between the copper backing of the target, and another $1/16$ -inch copper plate. It is difficult to estimate just how much inherent filter is present in the path of the radiation in any direction since it is pos-

¹ I am indebted to Dr. A. Marshak for assistance in making this check.

sible that some of the electrons pass right through the target and their energy is transformed into energy of radiation in the electron beam, were performed after the lead target had been replaced with a gold-plated target. In this case the gold

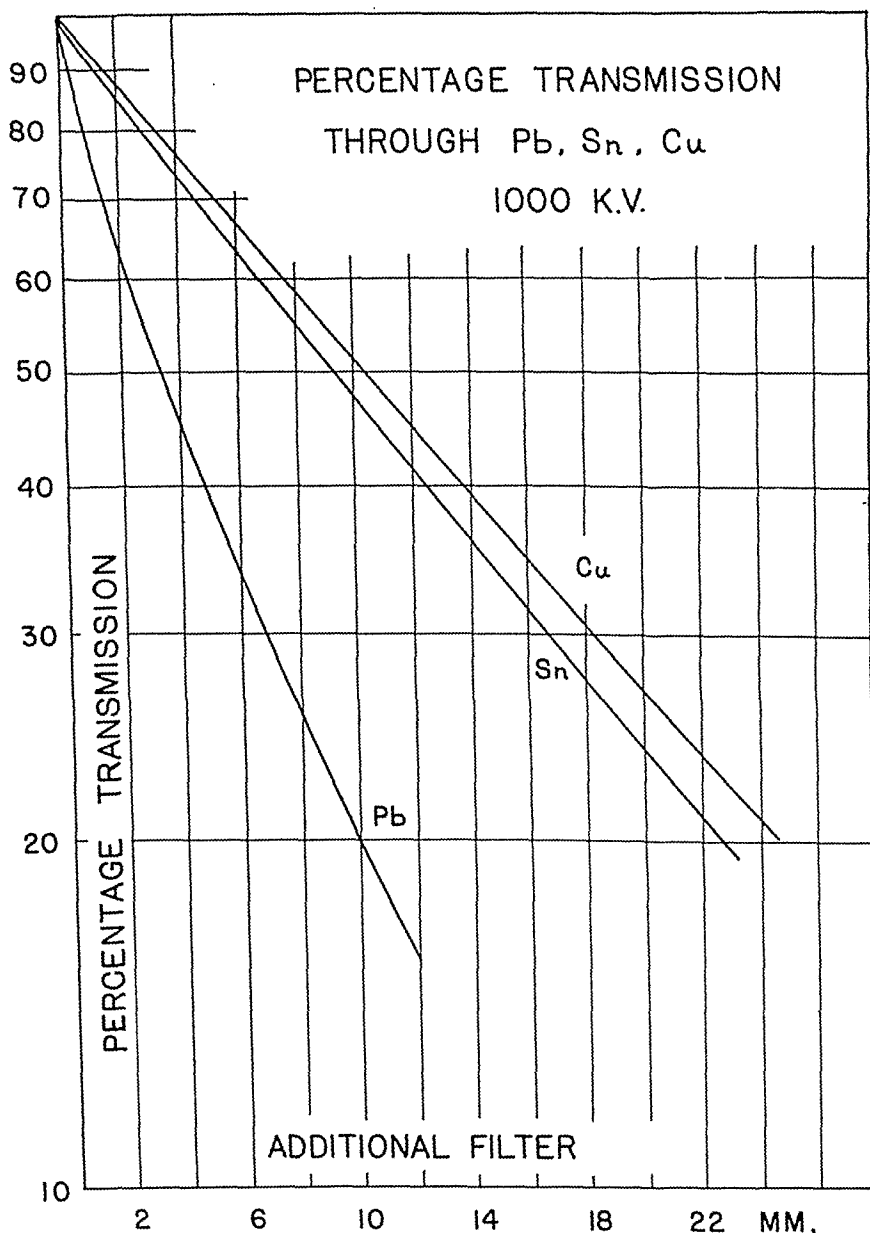


Fig. 2. Percentage transmission through lead, tin, and copper. Radiation parallel to the direction of the electron beam, 1,000 kv. Initial filter, 2.4 mm. Cu, 1 mm. Pb, 1 mm. Al, 2.6 mm. Cu, 1 mm. Al. Added filter placed between 1 mm. Pb and 1 mm. Al.

the water jacket or in the outside copper plate. However, the total thickness of copper in the horizontal direction is 5.2 mm. and this is taken as the inherent filter for the horizontal radiation. The experiments on the radiation, parallel to

is plated on $\frac{3}{64}$ -inch copper and another $\frac{3}{64}$ -inch copper plate forms a water jacket $\frac{1}{16}$ inch thick. Again the thickness of the copper is considered the inherent filter, and in this case is 2.4 mm. Cu.

The vertical radiation is used for clini-

cal work and the conditions of treatment of lead and copper filters added to the are: 1,000 kv., 70 cm. F.S.D., total filter inherent filter. The curves showing the 2.4 mm. Cu, 3.3 mm. Pb, 1 mm. Al, 2.6 results for the 90° radiation are shown in

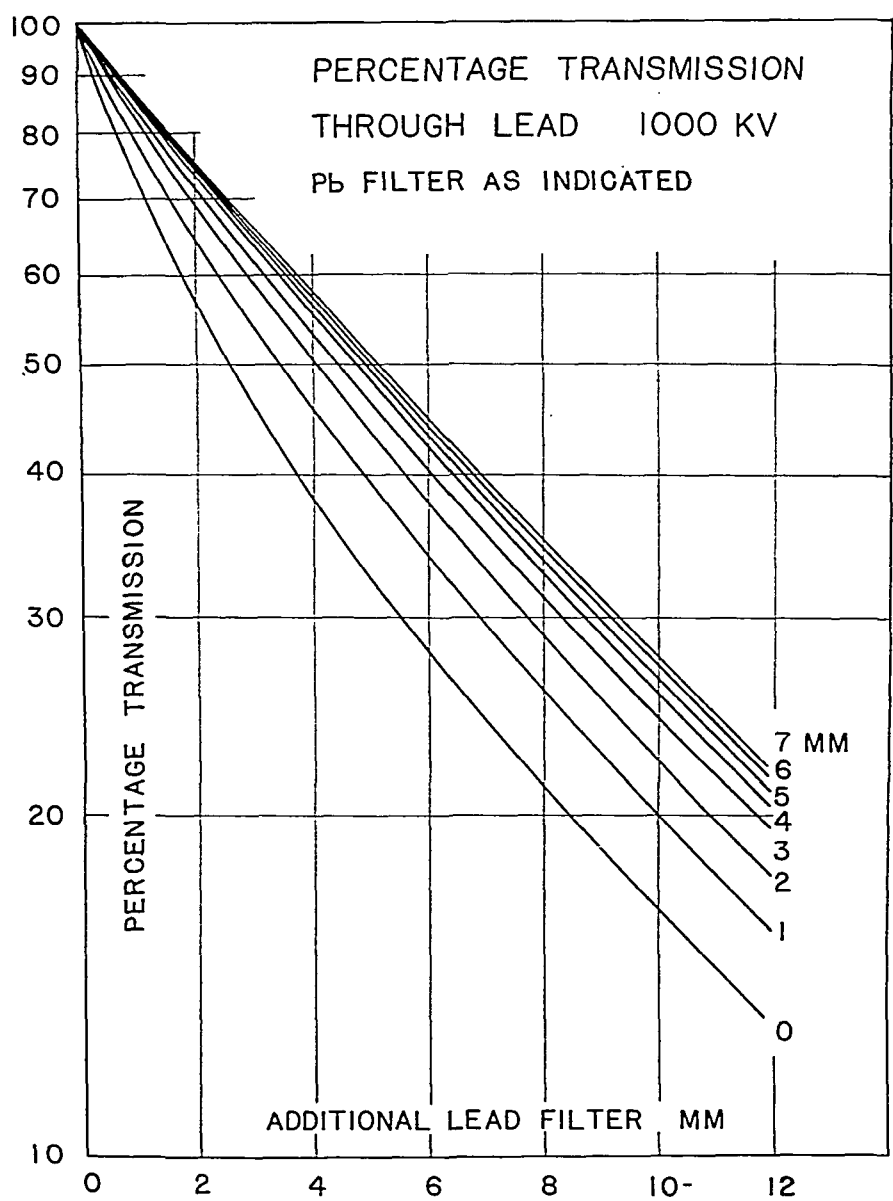


Fig. 3. Percentage transmission curves for lead, 1,000 kv. Radiation parallel to direction of electron beam. Initial filter, 2.4 mm. Cu, 1 mm. Al, 2.6 mm. Cu, 1 mm. Al. Additional lead placed between 2.4 mm. Cu and 1 mm. Al.

mm. Cu, 1 mm. Al. Under these conditions the x-ray output is 47 r/min./ma. The first measurements of the quality of the radiation were made with copper filters, and the half value layer in copper was determined with various thicknesses

Figure 1. It is evident that copper is not a satisfactory filter for supervoltage radiation, nor is it suitable as a means of determining the quality of the radiation. The copper absorption coefficient changes slowly with wave length for highly pene-

trating radiation, due to the fact that scattering is the predominant process of absorption at short wave lengths and relatively low atomic number absorbers. The so-called "true absorption," which varies approximately as the cube of the wave length, plays a minor part in the absorption of short wave lengths in copper but a larger part in the case of lead and other elements of high atomic number. Consequently, the quality of supervoltage radiation should be expressed in terms of its half value layer in lead or platinum.

Absorption curves of the vertical radiation for lead, tin, and copper are shown in Figure 2. This is for the radiation parallel to the direction of the electron beam and the conditions are as follows: 1,000 kv., 2.4 mm. Cu, inherent filter; added filter 1 mm. Pb, 1 mm. Al, 2.6 mm. Cu, and 1 mm. Al. Abscissæ represent millimeters of additional filter, while ordinates represent percentage transmission.

In Figure 3 the absorption curves for lead of the vertical radiation are shown, successive curves indicating the addition of one millimeter of lead. It is seen that so far as absorption in lead is a criterion of hardness, there is little advantage in adding more than 4 mm. of lead external filter for 1,000 kv. radiation. This is better seen in Figure 4, in which the half value layers in lead, tin, and copper are plotted as ordinates against added millimeters of lead external filter as abscissæ. The half value layer in copper for 1,000 kv. radiation, normal to the electron beam, is shown in the same figure. The total filtration for the horizontal radiation is somewhat greater than that for the vertical radiation and so the two beams are not strictly comparable. However, it is evident that the radiation parallel to the electron beam is more penetrating than that normal to the electron beam. For the former, with total filter of 2.4 mm. Cu, 2.6 mm. Cu, 2 mm. Al, the half value layer in copper is 10.2 mm., corresponding to an effective voltage of 475 kv., while for the latter, with 5.2 mm. Cu as total filter, the half value layer in copper is 6.9 mm.,

corresponding to an effective voltage of 290 kv. This gives a difference in effective voltage, as determined from half

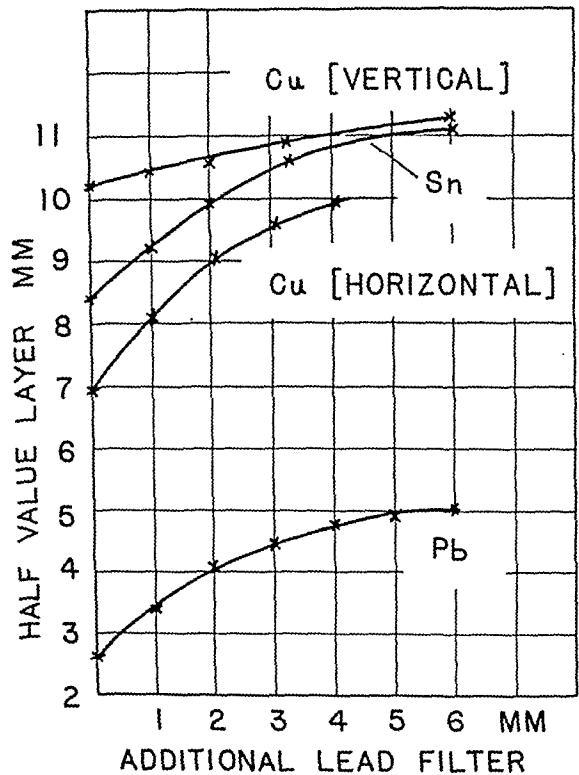


Fig. 4. Half value layers in lead, tin, and copper for 1,000 kv. radiation parallel to electron beam (vertical) and in copper for 1,000 kv. radiation normal to the electron beam (horizontal). Initial filters, vertical, 2.4 mm. Cu, 1 mm. Al, 2.6 mm. Cu, 1 mm. Al; horizontal, 5.2 mm. Cu.

value layer of copper, of 185 kv. in favor of the radiation parallel to the electron beam. This is in agreement with the results of Corrigan, Cassen, and Hayden (2). Data on relative intensities of the horizontal and vertical radiations would be interesting but such a comparison is not possible at present.

For clinical work, the filter is 2.4 mm. Cu, 3.3 mm. Pb, 1 mm. Al, 2.6 mm. Cu, 1 mm. Al, and the half value layers for this radiation are 4.6 mm. lead, 10.6 mm. tin, or 10.8 mm. copper. These correspond to mass absorption coefficients of 0.134, 0.089, and 0.072 for lead, tin, and copper, respectively. From the works of Read (12),

Jones (7), and Cuykendall (3), one can secure an approximate value of wave length corresponding to these absorption coefficients. From these experiments result the values 0.021 Å., 0.022 Å., 0.020 Å., with

been a more suitable substance than tin but for the lower voltages copper would be more satisfactory. However, tin was used as most suitable to cover the entire range with one material. The radiations at

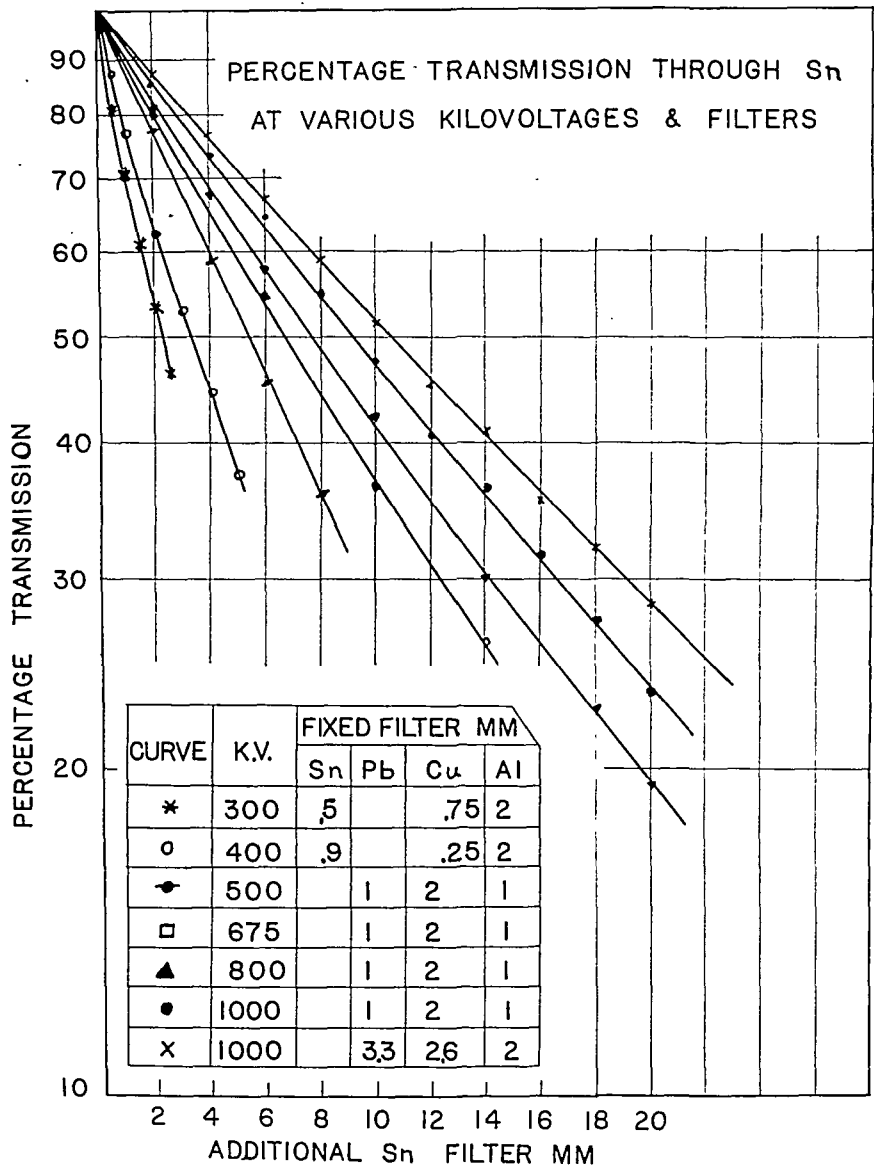


Fig. 5. Percentage transmission through tin at various kilovoltages and filters.

the value 0.021 Å. from the half value layer of lead being the average and probably the most accurate as well.
Absorption curves for tin, at various voltages and filters, are shown in Figure 5. For the higher voltages lead would have

300 kv. and 400 kv. were observed at an angle of 90° to the electron beam from a commercial 400 kv. machine; all the other values were secured from the Van de Graaf machine in the Collis P. Huntington Memorial Hospital.

SUMMARY

Absorption curves in lead, tin, and copper are given for the radiation at 1,000 kv. from an x-ray tube actuated by a Van de Graaf generator. For clinical use an added filter of 3.3 mm. Pb, 2.6 mm. Cu, and 2 mm. Al is used. This results in a mean wave length of 0.021 Å. as determined from half value layers in lead, tin, and copper, and a value of dose per minute per milliamperere of 47 r in air, at a treatment distance of 70 cm.

It is a pleasure to extend my thanks to my assistants, Messrs. H. S. Baxter and R. F. Cowing, for valuable aid in the construction of apparatus and the taking of data.

REFERENCES

- (1) CORRIGAN, K. E., and CASSEN, B.: Spatial Distribution of Radiation from a Supervoltage Roentgen Tube and its Significance in Therapy. *Am. Jour. Roentgenol. and Rad. Ther.*, **37**, 811-818, June, 1937.
- (2) CORRIGAN, K. E., CASSEN, B., and HAYDEN, H. S.: The Spatial Distribution of Radiation from a Supervoltage Roentgen Tube. *Am. Jour. Roentgenol. and Rad. Ther.*, **39**, 634-640, April, 1938.

- (3) CUYKENDALL, T. R.: The Absorption of X-rays of Wave Length 50 to 150 X.U. by Elements of Low Atomic Number. *Phys. Rev.*, **50**, 105-109, July 15, 1936.
- (4) DRESSER, R., TRUMP, J. G., and VAN DE GRAAF, R. J.: Production of Supervoltage Roentgen Rays by Means of an Electrostatic Generator. *Am. Jour. Roentgenol. and Rad. Ther.*, **38**, 758-761, November, 1937.
- (5) FAILLA, G., and MARINELLI, L. D.: Measurement of Ionization Produced in Air by Gamma Rays. *Am. Jour. Roentgenol. and Rad. Ther.*, **38**, 312-343, August, 1937.
- (6) FRIEDRICH, WALTER: The Measurement of Gamma Rays. *Am. Jour. Roentgenol. and Rad. Ther.*, **40**, 69-79, July, 1938.
- (7) JONES, M. T.: The Absorption of Ultra-short X-rays by Elements of High Atomic Number. *Phys. Rev.*, **50**, 110-114, July 15, 1936.
- (8) KAYE, G. W. C., and BINKS, W.: The Ionization Measurement of Gamma Radiation. *Am. Jour. Roentgenol. and Rad. Ther.*, **40**, 80-91, July, 1938.
- (9) MARSHAK, A., and HUDSON, J. CRAMER: Measurement of Roentgen-ray Dosage by Determining the Effect of Radiation on Chromosomes. *RADIOLOGY*, **29**, 669-675, December, 1937.
- (10) MAYNEORD, W. V., and ROBERTS, J. E.: Ionization Produced in Air by X-rays and Gamma Rays. *British Jour. Radiol.*, **7**, 158-175, March, 1934.
- (11) TRUMP, J. G., and VAN DE GRAAF, R. J.: Design of a Million-volt X-ray Generator for Cancer Treatment and Research. *Jour. Applied Physics*, **8**, 602-606, September, 1937.
- (12) READ, J.: The Absorption of Monochromatic X-ray Beams of Wave Length in the Region 50 to 20 X.U., in Lead, Tin, Copper, and Iron. *Proc. Royal Soc., A*, **152**, 402-417, Nov. 1, 1935.

RECOVERY FOLLOWING HUMAN OVARIAN IRRADIATION¹

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TWO of the fundamental but probably least well understood effects of irradiation upon living tissues are the processes of destruction and repair. In some organs and tissues it is difficult, if not impossible, to determine the degree of recovery which has taken place following radiation therapy. But human ovarian tissue is one in which return of function can be observed by the re-establishment of the menstrual and child-bearing functions.

The production of temporary sterilization by irradiation is a well-recognized and safe clinical procedure used throughout the world. Radiologists are familiar with the variability of the ovaries in relation to x-ray sensitivity, and with the strong recuperative power even a small amount of ovarian tissue may possess. It has been our custom to consider 500 r delivered to the ovaries sufficient to produce permanent castration in the majority of patients. However, a young individual may require a larger amount than a patient approaching the menopause because of the greater power of recovery in young ovaries. We all know that some of our patients menstruate again after varying periods of amenorrhea following the customary roentgen castration exposure.

The effect of irradiation on future offspring is not well understood. Whether an ovary irradiated so as to suppress the menstrual phenomenon for an extended time can recover to produce healthy ova capable of fertilization and development into normal children is not so definitely proved, but such occurrences, as reported here and elsewhere (2 and 10), tend to bear out this assumption. After studying

several hundred pregnancies, Murphy (6) stated that ovarian irradiation, prior to fertilization, has no detrimental influence upon the health or development of subsequent children.

Riboni (7) reports the case of a 27-year-old woman who was subjected to presumably permanent roentgen sterilization for a freely bleeding fibroid. She noticed mild menopausal symptoms and no menstrual periods for two years, at the end of which time she became pregnant and gave birth at term to twins. One was born dead after forceps delivery; the other was delivered spontaneously, and was in perfect health 15 years later. After 15 years of normal menstrual periods, the fibroid again caused symptoms and was removed surgically.

Kaplan (4) describes a 30-year-old woman with severe acute pulmonary tuberculosis, who received roentgen therapy to produce a therapeutic abortion. Since this did not occur in six weeks, a simple vaginal hysterotomy was done. She did not menstruate after the operation, but conception occurred ten months later. The pregnancy was allowed to go to term and a normal male child was delivered without difficulty. Fourteen months following birth, the child was healthy and normal in development.

Again, Kaplan (3) reports the case of a 36-year-old woman who was presumably permanently castrated by roentgen rays because of recurrent carcinoma in both breasts. She was amenorrheic for 14 months, but became pregnant and was aborted by evacuating the uterus through abdominal hysterotomy. Double ovum twins of normal ten weeks' development were found. The left ovary was large and cystic; the right small, hard, and fibrous. The left ovary showed two corpora lutea, one normal yellow body and the other cystic.

¹Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

Schiller (9) reports the history of a woman, aged 43 years, who had never been pregnant. She had uterine fibroids, and, on account of profuse hemorrhages, artificial menopause was induced by roentgen rays. Six months later menstruation reappeared once and after this the patient became pregnant. The child was normal when 18 months old.

Rongy (8) also records a similar instance in a woman, 30 years of age, who had been married nine years but who had never been pregnant. Because of almost continuous vaginal bleeding, she received four applications of roentgen rays over the ovaries. The bleeding ceased and the menstrual flow did not appear again. She conceived two months after the treatments and was delivered spontaneously of a living male child weighing 8 pounds 4 ounces.

The case of a 33-year-old woman who was practically incapacitated because of menorrhagia is reported by Masson (5). The flow was only partially controlled with 400 mg.-hr. of intra-uterine radium application. Consequently, ten months later, a menopausal dose (992 mg.-hr.) was given, and the patient had no menstrual flow for over three years. She became pregnant, but because of hemorrhages a total abdominal hysterectomy was performed and a threatened rupture of the uterus was found. The condition of the fetus is not recorded, but the patient made an uneventful recovery.

Blass (1) presents the case of a malignant epithelial neoplasm of the ovary in a 17-year-old girl in whom no disturbance of the menstrual cycle was produced with three courses of post-operative roentgen therapy within a period of six months. Smith (11) reports two cases of uterine cancer, aged 38 and 27 years, respectively, in whom intensive radium therapy produced clinical cures of over eight and nine years, with return of ovarian function after six years and six months and five years and eight months, respectively.

Steiger (12) reports a pregnancy following x-ray treatment of a fibroid uterus reaching almost to the umbilicus, in a

woman 39 years of age, after amenorrhea of four months' duration. This resulted in a normal nine-pound baby, well and strong one year after birth. He cites a case of Pankow, occurring after amenorrhea of 18 months. Three years after birth the child was undernourished as a result of war conditions. Zangemeister reported a normal child following a six-months' amenorrhea. Probably there are other cases reported under different subjects, and doubtless many have never been published.

This study includes two unusual clinical experiences following ovarian irradiation. The first showed exceptional resistance of an ovary to roentgen rays, although the microscopic study obtained after surgical castration was normal. The second is a five-year "arrest" of a malignant epithelial neoplasm of the ovary in a young woman. She had return of the menses two years after post-operative roentgen therapy of the remaining ovary, followed by the birth of a normal child, now nearly one and one-half years old. These cases show how complex the biologic reactions of the ovary may be, and the tremendous recuperative power the ovary may have.

Case 1. Miss S., a registered nurse, aged 37, was in good health until a hypodermic needle was broken off in her right arm in 1930. It was removed after some time and she developed an abscess at the site and another on the inner surface of the right elbow. This was followed by several series of metastatic abscesses throughout the body. These were always worse at the menstrual periods, requiring hospitalization and incision and drainage under anesthesia, with cultures showing the usual pyogenic organisms. Autogenous vaccines and female sex hormone therapy gave no relief, and the series occurred about every three to five weeks. Because of the definite relationship to the menstrual periods, the patient was given a temporary castration exposure of x-rays elsewhere (amount not known) in February, 1935, and there were no periods or abscesses for eight months. Menstruation returned in October, 1935, and the abscesses reappeared likewise.

The menstrual periods had always been irregular. They began at 16, occurred at two- or three-week or six- or seven-week intervals, and usually lasted one week, accompanied by severe pain and scanty flow. In the past history the patient had an acute attack of appendicitis in April, 1922, with removal of the appendix. The uterus, tubes, and ovaries were normal at that time. Two years later, in April, 1924, the patient had an operation to remove adhesions which produced partial intestinal obstruction. At that operation a cystic right ovary was removed which showed numerous follicular cysts and several corpora lutea microscopically. This procedure failed to have any effect upon the irregular menstrual periods. Three months later a second operation for acute intestinal obstruction was performed. She had two subsequent attacks of intestinal obstruction, not severe enough to require operation.

Altogether the patient was admitted to the Western Pennsylvania Hospital 13 times between 1932 and 1937, for incision and drainage of multiple abscesses, most of which occurred just before the onset of a menstrual period. For some reason, the immunity of the skin was lost at those times. The abscesses were always large, deep, and exceedingly painful, accompanied by considerable toxemia. In December, 1935, a positive blood culture of *Staphylococcus albus*, the same organism recovered from several of the deep abscesses, was obtained, and the patient almost lost her life, but responded to multiple blood transfusions.

In January, 1936, it was decided to give the patient a permanent sterilizing exposure of roentgen rays. She was 5 feet 11 inches (177.5 cm.) tall and weighed 101 pounds (46 kg.), calipering 15 cm. antero-posterior recumbent. She received 900 r (air measurement, 200 kvc., 0.75 mm. Cu plus 2 mm. Al) to each of two portals, 12 × 15 cm., over the anterior and posterior pelvis in six days, giving two areas 200 or 300 r each per day. The ovary received approximately 700 r. There was

little radiation sickness, and the patient had no periods or abscesses for eight months, but the abscesses recurred a few days before she started to menstruate in September, 1936. She correctly foretold the onset of the menses by the appearance of the first abscess. She was hospitalized three times for incision and drainage and in December, 1936, a larger quantity of radiation was given. This consisted of 1,500 r to each of two portals, as before, in nine days. The patient suffered considerable radiation sickness. The ovary received approximately 1,200 r, which failed, however, to produce permanent sterilization, the patient menstruating as usual in March and May, again preceded by abscess formation. Consequently with the return of abscesses and periods a panhysterectomy and left salpingo-oophorectomy was performed in June, 1937. Considerable scar tissue was found in the pelvis. The gross appearance of the left ovary was normal. The microscopic report showed, "senile atrophy of the uterus. Fibrosis and atrophy of the ovary." Nothing was found to account for the peculiar resistance of this remaining ovary to irradiation. The patient continues in perfect health to date (November, 1938), without a single abscess for 17 months.

Case 2. Miss E. I., an Italian housemaid, 21 years of age, was in excellent health until October, 1933, when she began to lose appetite and had a "bloated feeling" in the region of the umbilicus. There was gradually increasing enlargement and pain in the abdomen, suggesting pregnancy, when she was admitted to the Western Pennsylvania Hospital in March, 1934. However, her menstruation had always been regular, beginning at the age of 13, without endocrine abnormalities. She had lost 20 pounds (9.1 kg.) in weight in the past five months, which represented 15 per cent of her usual body weight.

The past and family histories were irrelevant.

Physical examination showed a chronically ill, young Italian girl, 5 feet 4 inches (160 cm.) tall, weighing 115 pounds (52.3

kg.). The rest of the examination was not significant except for the abdomen, which was filled with a smooth, rounded, symmetrical, firmly fixed mass about the size of a full-term pregnancy. It was not tender or fluctuant. The cervix was high in the pelvic cavity, but of normal consistency. The fundus could not be outlined separate from the mass, and it did not encroach upon the rectum. The clinical impression was an ovarian cyst, possibly malignant.

The serologic test for syphilis was negative. The hemoglobin was 80 per cent, the red blood cell count 4,190,000, and the white blood cell count 8,500 with a normal differential formula. Numerous urinalyses showed a trace to 3 plus albumen, with 10 to 30 white cells per high power field and occasional casts. The systolic blood pressure was 145, the diastolic 95.

At operation a large, semi-solid, cystic mass arose from the left side of the pelvis and extended to the under surface of the liver. A small amount of free, straw-colored fluid was present. The uterus, right tube, and ovary were normal. The tumor, with tube attached, was removed without rupture and weighed 13 pounds (5.9 kg.). Because the gross appearance of this tumor suggested a dermoid, the right ovary was not removed. The patient made an uneventful recovery.

The pathologist's report was as follows:

"Specimen is a nodular, ovoid mass measuring $36 \times 25 \times 20$ cm. and weighing 13 pounds (5.9 kg.). The external surface is coarsely lobulated, smooth and gray mottled with red. The cut surface varies from gray, red and gray to yellow, the latter areas being very soft and containing ragged cystic spaces filled with cloudy fluid. All tissue is fairly soft. The more firm areas are gray with small yellowish-gray patches. The soft areas are gray and appear somewhat papillary, evidently due to the partial breaking down of tissue which finally becomes complete in the ragged yellow areas. *Microscopic diagnosis:* Solid carcinoma of the ovary. Note: The complete lack of any detectable architecture and of any type of differentiation of the cells making up the tumor may lead one to designate this growth as an 'embryonal' type of carcinoma."

This tumor has also been called by some pathologists an atypical granulosa-cell tumor (Fig. 1).

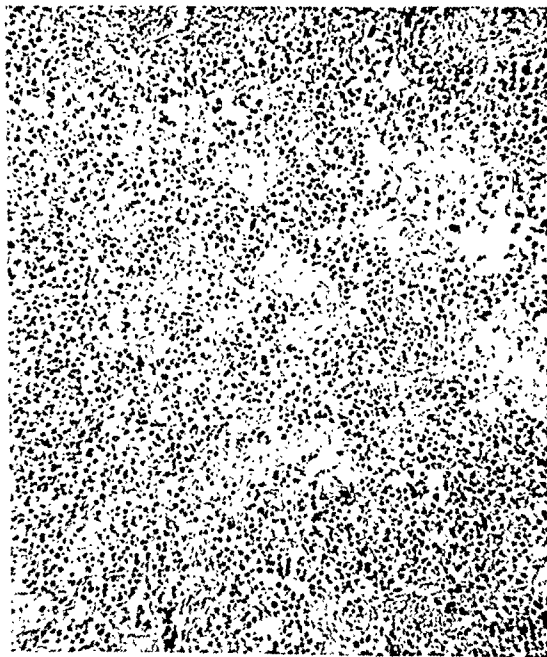


Fig. 1. Case 2. Typical low-power photomicrograph of malignant epithelial ovarian tumor showing embryonal characteristics. The cells are loosely and indefinitely arranged, and show variability in size, shape, and intensity of staining.

On the eleventh post-operative day high voltage roentgen therapy was started, because of the malignant nature of the tumor. The patient received 800 r (air measurement, 200 kvc., 0.75 mm. Cu plus 2 mm. Al) to each of four portals, 12×17 cm. about the pelvis, and to two portals, 7×18 cm. over the retroperitoneal regions, in three successive daily exposures, giving two portals 200 or 300 r each per day. Since she calipered 14 cm. from front to back recumbent, the estimated dose to the remaining ovary, assumed to be in the mid-pelvis, was 640 r. With this quantity of radiation the patient did not menstruate for two years.

Two months following irradiation the patient had severe hot flashes which were relieved by applying 300 r with the same technic as above to each of two temporal fields over the pituitary gland. She was followed in the Tumor Clinic at regular

three-month intervals, where she showed steady improvement. In the meantime she was married, but believed herself sterile. After an interval of amenorrhea for two years, she had three normal periods in February, June, and August of 1936, and a four months' pregnancy was diagnosed in February, 1937. Since the obstetricians predicted a normal course and infant, she was allowed to go to term. The pregnancy and delivery were without incident and a normal female infant, weighing 6 pounds 4 ounces, was born in July, 1937. The mother and child remain in perfect health at present (November, 1938), and the child is normal in every way. The mother has had three normal menstrual periods—in March, September, and November, 1938.

SUMMARY

1. The first patient demonstrated an unusual loss of immunity to serious cutaneous and subcutaneous infections definitely related to ovarian dysfunction, and a marked resistance of a microscopically normal ovary to roentgen rays.

2. A five-year clinical cure of a malignant epithelial ovarian neoplasm in a young woman is reported. This patient became pregnant after being amenorrheic for two years following post-operative roentgen therapy, and gave birth to a normal child.

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BIBLIOGRAPHY

- (1) BLASS, G.: Marked Resistance of Ovary to Roentgen Rays: Case. *Strahlentherapie*, 36, 370-372, April, 1930.
- (2) DÖDERLEIN, A.: Ray Treatment and Offspring. *Deutsche med. Wchnschr.*, 54, 1997-2001, Nov. 30, 1928.
- (3) KAPLAN, I. I.: Twin Pregnancy after Temporary Suppression of Menstruation Following Roentgen-ray Treatment for Mammary Cancer. *Am. Jour. Obst. and Gynec.*, 14, 40-44, July, 1927.
- (4) Idem: Post-radiation Pregnancy: Report of Case. *Surg., Gynec. and Obst.*, 50, 492, 493, February, 1930.
- (5) MASSON, J. C.: Pregnancy Following Menopausal Dose of Radium, with Impending Rupture of Uterus. *Surg. Clin. of N. A.*, pp. 853-855, August, 1933.
- (6) MURPHY, D. P.: Ovarian Irradiation and Health of Subsequent Child: Review of More than 200 Previously Unreported Pregnancies in Women Sub-

jected to Pelvic Irradiation. *Surg., Gynec. and Obst.*, 48, 766-779, June, 1929.

(7) RIBONI, S.: Twin Pregnancy after Presumably Permanent Castration for Intensely Hemorrhagic Fibromatosis of Uterus: Case. *Atti Soc. ital. di ostet. e ginec.*, 34, 252-257, March-April, 1938.

(8) RONGY, A. J.: X-ray Therapy in Disturbed Menstruation. *Am. Jour. Obst. and Gynec.*, 7, 169-172, February, 1924.

(9) SCHILLER, W., II: Pregnancy after Roentgen Treatment. *Wien. klin. Wchnschr.*, 37, 1190, 1191, Nov. 13, 1924.

(10) SCHMITT, WALTHER: New Considerations of the Question of Injury to Offspring Following Ovarian Irradiation. *Strahlentherapie*, 30, 24-64, September, 1928.

(11) SMITH, G. V.: Recrudescence of Ovarian Function after Heavy Irradiation: Two Cases. *New England Jour. Med.*, 214, 725-727, April 9, 1936.

(12) STEIGER, M.: Pregnancy after Roentgen Exposures for Myoma of Uterus. *Schweiz. med. Wchnschr.*, 51, 1084-1087, Nov. 24, 1921.

DISCUSSION

MILTON FRIEDMAN, M.D. (New York City): The ovary is essentially a radio-sensitive organ but under certain conditions it is radioresistant. The ovary of young women is radioresistant and requires considerable radiation to castrate permanently. However, the age of the patient is not always an indication of the potency of the ovary.

It is not uncommon to have women continue to menstruate beyond the age of 50 or 55. I recently observed a 70-year-old woman who had had an apparent menopause (cessation of menses), but without symptoms, twenty years ago at the age of 50. She complained of recurrent uterine bleeding, and was found to have corpus carcinoma. Her uterus, and both tubes and ovaries were removed. She immediately went into a typical menopausal picture of nervousness, hot flushes, etc. In this patient there probably was a continuation of ovarian activity beyond clinical menopause.

The frequent absence of menopausal symptoms after the cessation of menstruation is, in many instances, suggestive evidence of residual ovarian activity. It is not uncommon in those patients to find on bio-assay that there is some residual estrin present in the blood and urine, and that the prolactin does not increase compensatorily.

The clinical importance of this point

arises when we are castrating a woman near the age of menopause for marked benign breast hyperplasia or marked cystic disease of the breast causing symptoms of discomfort. A simple castration dose, under those circumstances, will occasionally not be followed by a complete resolution of the breast hyperplasia, and it has been our experience, or our conclusion, that a double castration dose is necessary—at least 800 to 900 roentgens delivered to the ovary—in order to completely eradicate all ovarian activity. We have probably all seen other instances in which a larger dose than usual was found necessary to eradicate a particular ovary.

Further evidence of the persistence of ovarian activity post-menopausally is found in women who have carcinoma of the breast and at the same time cystic disease. Colonel Whitmore, in his exhibit upstairs, displays one such case of a 70-year-old woman who has a carcinoma of the breast together with cystic disease. In that breast are also found areas of lobular hyperplasia of the terminal buds, suggesting active estrin influence. When you examine the epithelial lining of the more or less quiescent cystic areas, you find marked evidence of proliferation. This does not imply that the estrin was responsible for the epithelial proliferation in such cystic areas, but it is likely that had that patient been deprived completely of any estrin influence on the breast, either at physiologic menopause or by castration, the total amount of epithelial hyperplasia would have been considerably diminished.

HYMAN I. TEPERSON, M.D. (Brooklyn, N. Y.): I might add that it has been my experience—and probably some of you have had a like experience—that in cases in which women are subjected to radium treatment preceded by curettage for hyperplasia of the endometrium, in order to suppress their menstrual function, a number of these cases did not respond to the radium treatment.

These cases were subsequently sent to us by the gynecologist who performed the

operation and radium insertion, for additional radiation to the pelvis. We have noted that some of these cases did not respond as expected.

A repetition of a course of therapy at some interval likewise gave discouraging results.

It had occurred to us that, as Dr. Jenkins¹ has brought out this morning, there must be some inter-relationship between glandular functioning. We have investigated some of these cases in relation to thyroid and adrenals. We have found a number which proved to be hypothyroid cases, some were hyperthyroid, and in one case we found a hypofunction of the adrenals.

The complementary administration of thyroid to these hypothyroid cases immediately gave a response which we should have received with radiation therapy alone. These women who previously had not ceased their menstruation with radiation, both radium and x-ray, immediately responded and ceased their activity after thyroid or adrenal therapy, as the case might have been.

HENRY SCHMITZ, M.D. (Chicago): The presentation of this paper has a great deal of scientific interest. One might say that it is against all known biological laws that recoveries occur as described. However, such a single instance does not prove the law, but rather an exception. May I cite a case which bears on this subject.

A young woman had a chronic cervicitis and was treated at another hospital with radium, which brought about amenorrhea. About six years afterward this woman, without ever menstruating, became pregnant. She was then delivered at term by Cæsarian section, due to fibrotic stenosis of the cervical canal. Five years later she again became pregnant, though she had not menstruated. In other words, here was a patient who had a permanent radia-

¹ "The Treatment of Hyperthyroidism with a Consideration of Other of the Ductless Glands as a Trigger Mechanism: Based upon the Observation of 360 Cases," by I. Warner Jenkins, M.D., F.A.C.P. *RADIOLOGY*, 32, 340-345, March, 1939.

tion amenorrhea and, in spite of that, became pregnant twice.

The structures in the ovary which we must consider in the radiation therapy are three: the primary follicle, which is a resting follicle; the maturing follicle, which is differentiating, and finally the matured follicle, which has reached complete growth maturity. The application of radiations destroys the maturing follicle first, the resting primary follicle next, and the mature follicle, or corpus luteum, last.

If, for instance, the radiation is given during the last half of the menstrual cycle when the follicle has matured, one may be sure that the patient is going to menstruate, but she will probably not menstruate the month afterward, as follicles will not mature any more. Ovulation will thereafter not occur again because all the follicles, the resting and maturing ones, will have been destroyed by the x-ray. If menstruation recurs later on after one or more years, it must be assumed that the primary follicles had not been totally destroyed and, therefore, re-exert their function.

The fact that an apparently healthy child has been born of a woman whose ovaries had been subjected to radiation does not mean that the next generation of this child, when he or she may have offspring, may not show mutations and malformations due to radiation injuries of the chromosomes or genes of the ovum.

Therefore, it is extremely important to be sure that when we do castrations we do them as perfectly as we can; rather use a much larger dose than we would ordinarily, than to subject the patient to the possibility of having a child born after the irradiation of the ovary.

Another point I wish to discuss has to do with the influence of endocrines on the breasts, which is so often brought up. The breast is entirely under the function of the hormones of the ovary as well as the pituitary. The hormones of the pituitary are the follicle-stimulating and the luteinizing hormones. The follicle hormone brings about development of the primary ovarian

follicle and the luteinizing hormone causes the granulosa cells to luteinize. Proliferating and secreting changes are rhythmically developed in the functioning epithelium of the breasts as in that of the endometrium.

If a patient has been castrated, whether surgically or radiologically or has passed the menopause, the follicle-stimulating hormone alone remains active. The hormone may be extracted from the urine and blood. And this hormone is responsible for the development of the flaccid small breasts seen in mature women to the larger and full breasts seen during the periods of senility or after castration.

The amounts of follicle-stimulating and luteinizing hormones thrown into the body during ovulation are so small that they cannot produce permanent proliferations if functions are normal. Hence one need not worry to use the hormones in substitution therapy.

The luteinizing hormone may be more important in the pathology that one sees in the breasts.

GENTZ PERRY, M.D. (Evanston, Ill.): I did not expect to report this case but Dr. Jacox's very interesting and practical paper prompts me to add this case report.

The case I wish to report was a young colored woman, Mrs. A. L., referred to me by a local physician, for radiation therapy of the breast carcinoma which the pathologist reported as an ordinary adenocarcinoma. At that time the patient was 36 years of age. She had been married 13 years and had been pregnant twice, with a miscarriage about the fourth month each time. Both blood and spine Wassermann tests were negative. The carcinomatous development had been going on for about five months and was quite well advanced with beginning ulceration of the carcinomatous mass, which was about six by seven centimeters in size. There were two palpable axillary lymph glands on that side.

We gave the patient 6,463 r through five portals of entry—200,000 kv.—using a Thoraes filter equivalent to 2 mm. of

copper at 50 cm. distance. That radiation therapy, by the way, caused axillary nodes to disappear entirely and reduced the size of the tumor mass very much, but it was *immediately* followed-up—as we do in all cases—by simple mastectomy, a surgical removal of the remainder of the *mammary gland only* without invading the axilla.

The end-results appeared to be an eradication of the carcinomatous invasion, and following the stereotype plan of trying to prevent recurrence, we gave 500 r of 200 kv. through the same Thoraeus filter to each of the ovaries, with the idea of, at least partially, sterilizing the patient or bringing on the menopause.

About seven months after treatments to her ovaries, which were given after she had had her mastectomy, she again menstruated and kept on menstruating regularly for four months until she again became pregnant and was delivered of a normal full-term baby weighing 6 pounds 3 ounces, that is now approximately seventeen months old. The child is perfectly normal and one of the features of the case that was rather agonizing to us physicians was that the mother persisted in nursing the baby

on the other breast, which she did for some three months.

She has not shown any signs of recurrence and is again menstruating normally. Her age at the present time is 41 years. Her healthy child now weighs about twenty-eight pounds.

HAROLD W. JACOX, M.D. (*closing*): I wish to thank the discussants for their help. I really did not realize there was this much interest.

I could not give all the references in the paper; I tried to collect as many cases as I could that bore on this subject. However, Dr. Schmitz has raised such a pertinent question I would like to add this.

He said we do not know what is going to happen to the second generation. That is perfectly true. The work has been done on rats and other laboratory animals and that is a fine thing; we ought to know about that. But we do not know what effect alcohol and certain poisons are going to have on the second generation, either. Perhaps poisons and irradiation act somewhat the same in producing these later damages.

A PLEA FOR THE MORE FREQUENT USE OF THE LATERAL ROENTGENOGRAM IN THE DIAGNOSIS OF PREGNANCY

By MAXIMILIAN J. HUBENY, M.D., F.A.C.R., F.A.C.P., and PERCY J. DELANO, B.S., M.D., *Chicago*

From the Department of Roentgenology of the Cook County Hospital

AS early as 1896, the roentgen ray was suggested as an aid in the diagnosis of pregnancy, but early attempts in this direction were rather disappointing. According to Case (1), Levy-Dorn, in 1897, showed the skull of a fetus in a roentgenogram, but exposures with the technic then available often required an hour and a half, or more!

So little was known about the roentgenographic characteristics of pregnancy that, in 1908, Bouchacourd concluded that the demonstration on a plate of a fetus *in utero*, might well be considered a sign of fetal death.

According to Hess (2), ossification of the fetal skeleton begins at the seventh week. Jungmann, by the use of the Potter-Bucky diaphragm, has recognized pregnancy as early as the eighth week.

Bartholomew, Sale, and Calloway, from repeated examinations, have decided that diagnostic films can be expected in about one-third of the cases, by the beginning of the fifth month.

Though the use of the roentgen ray is frequently stressed to-day for its value in early diagnosis (3), yet the Aschheim-Zondek test, with its approximate 97 per cent accuracy, would seem to render

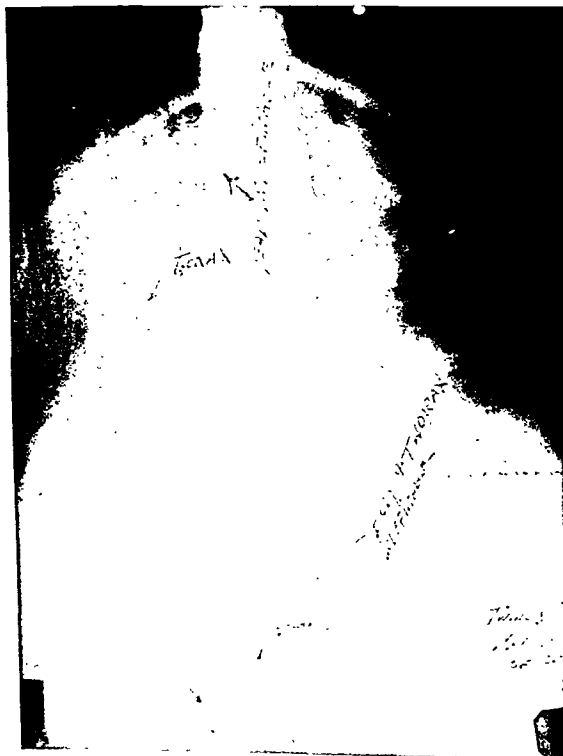


Fig. 1-A.

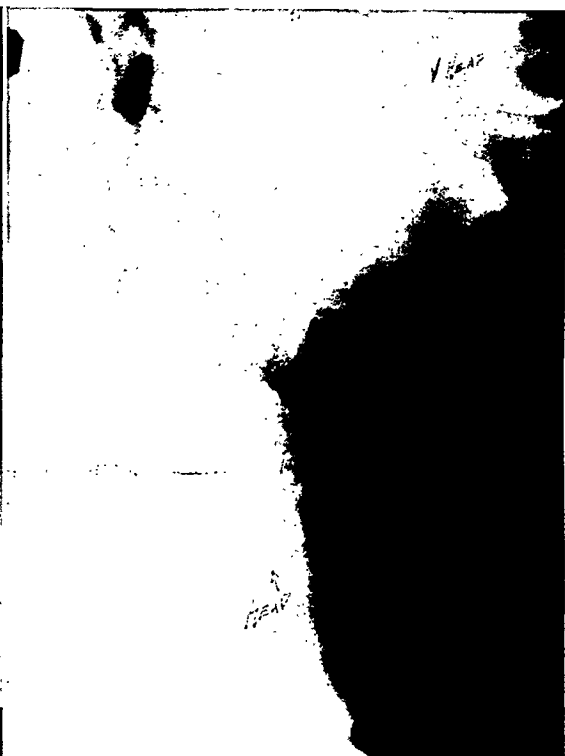


Fig. 1-B.

Fig. 1-A. One fetal head in pelvis, but no accompanying skeleton. Also, a fetal skeleton present without head of the above is probably due to movement of the unfixed parts of the fetus, the head of which shows in pelvic inlet.

Fig. 1-B. Study of films A and B clarifies doubt of multiple pregnancy.

most unwise the employment of such hazardous procedures as pneumoperitoneum and the injection of contrast material.

Brault (6) urges more frequent examinations and believes the effect of the rays on the fetus to be negligible. Moloy and Swenson (2) estimate the total radiation reaching the ovary and developing fetus, from the average series of films, to be 5.3 r. Eisaman (8) and Reinberger and Russel (5), in comprehensive reviews of the subject, urge more intensive study of pregnancies through roentgenograms, but inject a timely note of warning as to the limitations of this type of examination.

In reviewing large numbers of films in pregnancy cases at the Cook County Hospital, we have been repeatedly struck with the vast amount of information to be gleaned from the lateral projections, and have thought the matter worth commenting upon, since, until rather recent times, the lateral projection has received some-

what less attention in the literature than the supine and prone positions, or stereoscopic elaborations of each.

Shäfer (7) has often emphasized the value of the lateral view, and Pickhan (4) has worked with increasing filtrations in the lateral position, using in some cases as much as 0.6 mm. of copper to determine what could be done by making the ray more penetrating. Sante (11) calls attention to definite advantages possessed by the lateral views. Roberts (9) illustrates a striking case in which a lateral view shows a triple pregnancy: two of the heads lie in the same vertical plane and must indeed have led to ambiguity in an anteroposterior scout film.

In the early months, while the fetal skull or other identifiable part is still within the maternal pelvis, the anteroposterior, or in some cases the prone, positions are doubtless the ones of choice. A lateral view here would merely mask the



Fig. 2-A.

Fig. 2-A. No definite findings of pregnancy.

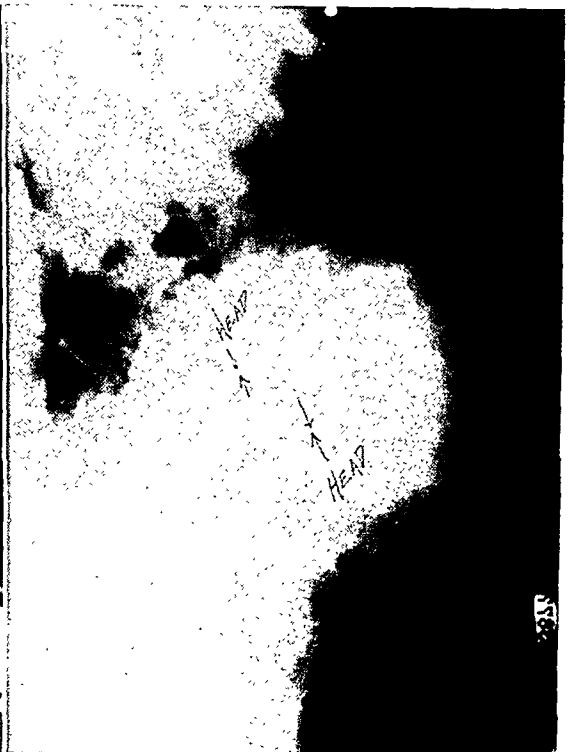


Fig. 2-B.

Fig. 2-B. Twin pregnancy demonstrable; one breech in pelvis, one in fundus; heads together.

fetal outline beneath the dense shadows of the innominate bones. Goethals (10) interprets stereoroentgenometric results with the aid of a dummy.

It is in the later months, when the fetal parts have risen out of the pelvis, that we have found increasing utility in the lateral exposure.

Certain technical procedures, in connection with roentgenography in pregnancy, have come to be a part of our routine, because their value to us has been so frequently evident. First, the abdominal binder has come to be considered rather indispensable. We prefer it to other methods for compression of the abdomen and immobilization of the fetus. The prone position we dislike for later cases, since it is not without danger, and we believe the same principle applies in lesser measure to the practice of employing a pneumatic compression bag. Next, we

instruct the patient to take a breath and hold it; we then wait about two seconds before making the exposure. We have found this device one of the best for stilling fetal movement.

In addition to the anteroposterior and lateral views, we often take one or more obliques.

Three cases are illustrated here in which the diagnosis probably would have been missed had we had only anteroposterior views. It might be mentioned, in passing, that the complete series taken in the larger diagnostic clinics are often dispensed with in smaller centers, and one film, which is usually an anteroposterior, taken. This is regarded as a scout film, and the most informative of any which could be employed. It is to this use of the anteroposterior view that we call particular attention.

In Figure 1, *A* and *B*, we are illustrating

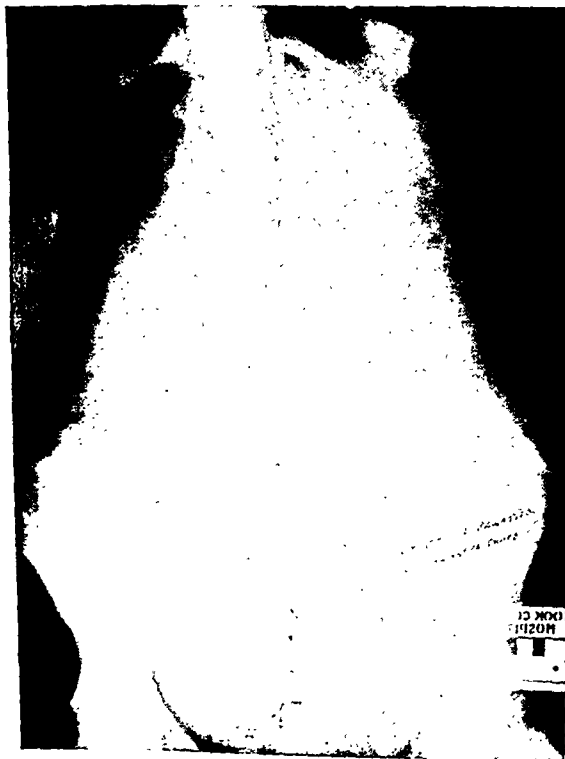


Fig. 3-A.

Fig. 3-A. No definite findings of pregnancy.



Fig. 3-B.

Fig. 3-B. Arrow No. 1: Head outline of one fetus. Arrow No. 2: Thoracic cage of second fetus. Numerous extremity shadows present. Twin pregnancy demonstrable; one breech in pelvis, one in fundus; heads together.

a twin pregnancy. The anteroposterior view shows the head of one, and the thorax and major portion of the spine of the other fetus. Very misleading! The lateral view shows the true state of affairs, in a relatively advanced case.

The second set of illustrations, Figure 2, *A* and *B*, shows an anteroposterior view which is essentially negative, so far as definite evidence of fetal parts is concerned. The diagnosis of pregnancy would probably be altogether missed from this film alone. The lateral indicates a twin pregnancy—one breech in the pelvis, one in the fundus, and the heads together. This is probably about a six months' pregnancy. The history was indefinite.

Figure 3 shows an anteroposterior view which we do not think is very suggestive of pregnancy. The lateral view again shows two heads with good detail.

SUMMARY

We believe that the lateral roentgenogram has not received sufficient emphasis for its value in the diagnosis of pregnancy.

BIBLIOGRAPHY

- (1) CASE, JAMES T.: *Obstetrics and Gynecology*, edited by Arthur H. Curtis. W. B. Saunders Co., Philadelphia, 1933.
- (2) Quoted by MOLOY, C., and SWENSON, PAUL C.: *The Use of the Roentgen Ray in Obstetrics: Diagnostic Roentgenology*, Ross Golden, editor. Thomas Nelson and Sons, New York, 1938.
- (3) HEIDLER, HANS: *Die Röntgendiagnostik in der Geburtshilfe und Gynäkologie*. Med. Klin., 29, 1163-1166, Aug. 25, 1933.
- (4) PICKHAN, A.: *Zur Bildtechnik seitlicher Schwangerschafts- und Beckenaufnahmen. Erzielung gleichmässig belichteter Röntgenfilme durch ausgleichende Strahlenfilterung*. Arch. f. Gynäk., 153, 578-583, 1933.
- (5) REINBERGER, JAMES R., and RUSSEL, PERCY B., JR.: *The Value and Limitation of Roentgen Rays in Obstetrics*. Am. Jour. Obst. and Gynec., 29, 235-239, February, 1935.
- (6) BRAULT, P.: *De l'emploi des rayons X en obstétrique*. Bull. Soc. d'obst. et de gynéc., 24, 442, July, 1935.
- (7) SHÄFER, G.: *Untersuchung geburtshilflicher Missverhältnisse durch die seitliche Beckenaufnahme*. Arch. f. Gynäk., 161, 373-376, 1936.
- (8) EISAMAN, J. R.: *Roentgenography in Obstetrical Diagnosis*. Am. Jour. Roentgenol. and Rad. Ther., 35, 777-781, June, 1936.
- (9) ROBERTS, R. E.: *Radiology in Obstetrics: A Consideration of its Dependability*. British Jour. Radiol., 9, 415-430, July, 1936.
- (10) GOETHALS, THOMAS R.: *Breech Deliveries, with Reference to X-ray Measurements of the Fetus and Maternal Pelvis*. Am. Jour. Obst. and Gynec., 26, 715-729, November, 1933.
- (11) SANTE, L. R.: *Manual of Roentgenological Technic*. Edwards Brothers, Ann Arbor, Michigan, 1937.

THE COMPUTATION OF DIMENSIONS IN PLANIGRAPHY WITH MATHEMATICAL INSTRUMENTS

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BY planigraphy we mean the visualization, localization, or mensuration of objects occupying specific planes in the radiograph. Certain standard conditions, namely, target film distance and

has shown methods of graphical reconstruction of the planes produced. In this paper we wish to outline methods of localization and plane production which are not dependent on graphical methods, and to show the

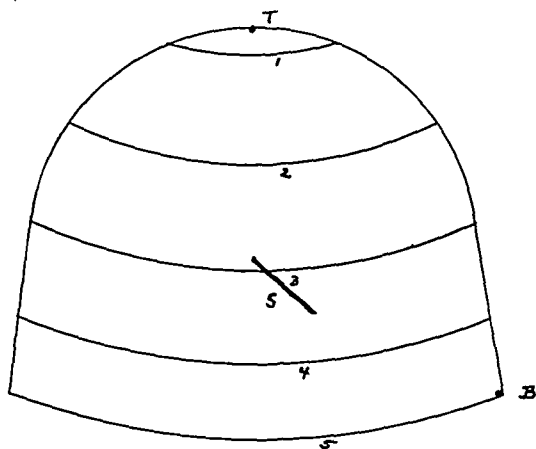


Fig. 1.

Fig. 1. This is a drawing of the model used in this work. It illustrates the levels of the rings, their markings, the markers for top and bottom, and the central mass of solder placed for localization.

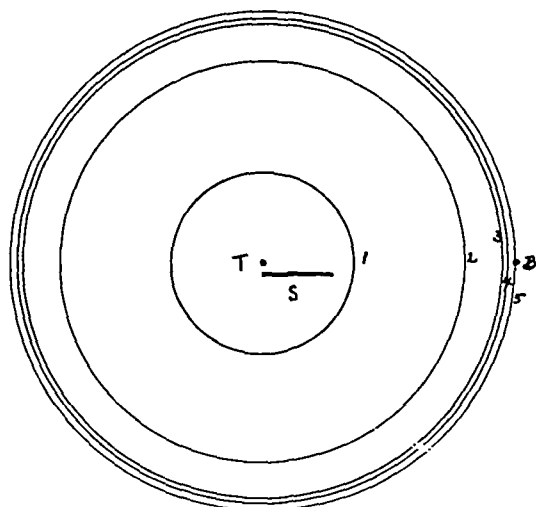


Fig. 2-A.

Fig. 2-A. This shows the projection of the rings of the model when taken with target above the axis of the model.

target shift distance are easily established. Graphical methods of planigraphy have been presented by Kaufman (1, 2, and 3). We feel that while this method is adequate and accurate, a more simple and more rapid method could be applied. When standard conditions are used for each case, mathematical tables for computation as well as certain well known precision instruments such as the pantograph and planimeter are applicable. The derivation of tables and application of mathematical instruments will be presented.

Kaufman (1, 2, and 3) has given in three articles a very clear and detailed description of the methods of planigraphy and

application of the use of mathematical instruments to this problem. It is assumed that the reader is fully conversant with the descriptions of Kaufman so that the methods and relationships produced in planigraphy will not be reviewed here.

The degree of spread of a point in space is determined by the target shift and the height, h , of the point above the plate. Kaufman has drawn graphs to illustrate this relationship. For purposes of computation the computed values for shift, S , for three target shifts, 7.5, 15, and 22.5 cm., are recorded for planes at intervals of 2 cm. above the plate. H , the tube height, is taken as 80 cm. As an aid in interpolation

the value $\Delta S/\Delta h$ for each pair of planes is listed. Numerically, this is equal to the change in shift per centimeter in the region and corresponds analytically to the slope ds/dh for the shift height curve or standard

by wires encircling the object approximately 2 cm. apart and parallel to the base. An irregular piece of solder was embedded in the wax for localization of objects and the top and bottom of the mass were

TABLE I

In the following table, h represents the height in centimeters of any plane above the level of the plate. S is the shift in centimeters produced on the plate, of the image projection, when the target is shifted T centimeters. S is listed for three standard shifts of the target, 7.5, 15, and 22.5 cm. After each value of S there is listed $\Delta S/\Delta h$ which shows the change in S per cm. of change of h in the region of plane height, h . This is used for interpolation. F is the factor by which linear measurements on the plate must be multiplied to give true linear measurements on the level of the plane considered the height of which is h . F^2 is the same conversion factor for areas. In this table the height, h , of the target is 80 cm.

h	S ($T = 7.5$)	$\Delta S/\Delta h$	S ($T = 15$)	$\Delta S/\Delta h$	S ($T = 22.5$)	$\Delta S/\Delta h$	F	F^2
0	.0	.09	.0	.18	.0	.27	1.00	1.00
2	.19	.09	.38	.18	.58	.27	.975	.950
4	.39	.10	.78	.20	1.18	.30	.950	.902
6	.61	.11	1.22	.22	1.82	.33	.925	.855
8	.83	.11	1.66	.22	2.50	.33	.900	.810
10	1.07	.12	2.14	.24	3.21	.36	.875	.766
12	1.32	.13	2.65	.26	3.97	.38	.850	.722
14	1.59	.13	3.18	.26	4.77	.40	.825	.680
16	1.88	.14	3.75	.28	5.62	.43	.800	.640
18	2.18	.15	4.37	.31	6.55	.46	.775	.600
20	2.50	.16	5.00	.32	7.50	.48	.750	.562
22	2.84	.17	5.69	.35	8.53	.51	.725	.525
24	3.21	.18	6.43	.37	9.64	.55	.700	.490
26	3.61	.20	7.22	.39	10.83	.60	.675	.455
28	4.04	.21	8.08	.43	12.12	.64	.650	.422
30	4.50	.23	9.00	.46	13.50	.69	.625	.392

This table provides a readily available chart to show the relationships between shift of points at different target shifts. It also lists correction factors for linear and area distortions produced by the divergence of the beams of x-rays.

depth curve of Kaufman. Since the beams from the x-ray tube diverge, the image on the plate is increased by projection by a factor which is equal to $H/(H-h)$. Consequently, all linear measurements on the plate must be multiplied by a factor which is unique for each plane in order to convert the measurements to the true distances in the level of the plane of the object radiographed. This factor is numerically equal to $(H-h)/H$ and is recorded in Column F of Table I. The area projection is changed by a factor equal to the square of the linear change and is recorded in Column F^2 . The changes in dimensions due to divergence of the beam are not to be confused with the shift produced by moving the target. To illustrate the practical use of this table, the methods of reconstruction and determination of planes and localization of objects are outlined herein. This work was done on a wax model (Fig. 1). The levels were marked

marked by small wires embedded in the wax. The results obtained by planigraphy are illustrated in Tables II and III and are compared with distances actually measured on the model. The volume was determined by displacement of water.

Determination of levels of the arbitrary wire planes was carried out by superimposing the image of the marker on the bottom of the object in the two films and then measuring the shift of the rings which resulted (Figs. 2-A and 2-B). In the actual clinical use of this method it would be more convenient to superimpose objects in the same plane which were to be plane localized and then measure the separation of the base marker. Either method would give rise to values for shift referred to the base of the object radiographed (column Shift b , Table II). The measured distance of the base of the object was 2.1 cm. above the film, therefore by use of Table I it is found that the base markers should have

a shift referred to the plate of 0.20 cm. This value must be added to all the shifts referred to the base and give the true values for the shift referred to the plate. This is recorded in column Shift p . Using Table I

irregular plane outlines, as would be found in actual cases, Kaufman (2) has described a polar co-ordinate method of reconstruction of the similar plane areas. This can be done accurately and rapidly by means

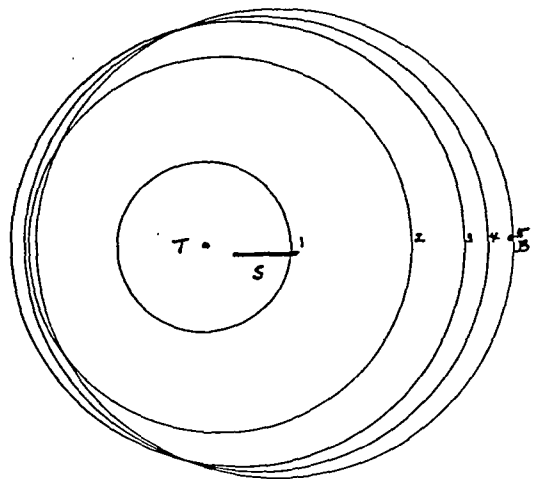


Fig. 2-B.

Fig. 2-B. In this the target has been shifted 15 cm., producing a shift of the rings from their concentric projection in Figure 2-A.

Fig. 2-C. This shows the use of multiple exposure for plane localization. The plate was shifted so that circle No. 2 was superimposed in the picture. All other circles are double.

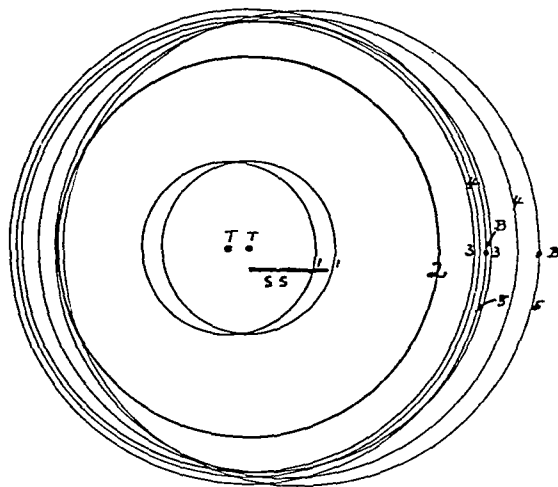


Fig. 2-C.

again the values of shift from the plate and the values for h above the plate are found. Subtracting the distance of the base from the film the true heights of the planes from the base were computed, h from b . Under Column, h actual, the values measured on the object are recorded showing a satisfactory agreement.

For the determination of linear distances the diameters of the circles of the planes were chosen. In the second group in Table II the measured diameters are listed for the five rings. This is the diameter measured on either of the two films. From the values already obtained for the heights, h , of the planes, the values of F , in Table I, are found by interpolation and each diameter measured is multiplied by its respective factor. This gives the computed actual diameter of the rings and is in satisfactory agreement with the measured diameters. This represents a very simple problem when the planes are circles. For

of the pantograph. The desired plane is found by the superimposition of its images, after which it is traced on paper. Its height is determined from its shift and the factor F interpolated from Table I. The pantograph arms are then adjusted so that a line of unit length on the tracing is diminished by an amount proportional to factor F . Then the tracing is outlined by the pantograph which reproduces the exact linear outline of the limits of the plane radiographed.

The determination of areas of planes is carried out in a similar fashion. The areas of the projected planes as seen on the plate are traced and their areas determined by means of a planimeter. If no planimeter is available, the area is outlined on a piece of good uniform paper, cut out, and weighed on an accurate balance. The weight of one square centimeter of the paper is then found and the area of the irregular surface computed. This is listed

in the third set of figures in Table II under area on p . From the previously computed heights of the planes the conversion factors for areas, F^2 , are found by interpolation from Table I. These are multiplied by

The determination of volume is made easily now with the previously determined data. In the second column under the determination of volume in Table II, are listed the actual computed areas taken

TABLE II
Target Shift 7.5 cm.

Level	Shift b.	Shift p.	h. from p.	h. from b. comp.	h. actual
Top	0.85	1.05	9.8	7.7	7.9
Ring 1.	0.85	1.05	9.8	7.7	7.9
Ring 2.	0.67	0.87	8.3	6.2	6.1
Ring 3.	0.43	0.63	6.2	4.1	4.1
Ring 4.	0.18	0.38	3.9	1.8	1.9
Ring 5.	0.00	0.20	2.1	0.0	0.0

Determination of Linear Dimensions

Level	Dia. on p.	Comp. actual dia.	Actual dia.
Ring 1.	3.91	3.42	3.50
Ring 2.	8.79	7.93	7.90
Ring 3.	10.44	9.66	9.75
Ring 4.	10.97	10.42	10.50
Ring 5.	11.05	10.75	10.75

Determination of Area of Planes

Level	Area on p.	Comp. actual area	Actual area
Ring 1.	12.0	9.2	9.6
Ring 2.	60.5	49.0	49.0
Ring 3.	86.0	74.0	74.3
Ring 4.	93.5	84.2	90.8
Ring 5.	95.8	90.8	90.8

Determination of Volume

Level	Comp. area	Mean area of element	Comp. thickness of vol. element	Vol. of vol. element
Ring 1.	9.2	0.0	0.0	0.0
Ring 2.	49.0	29.1	1.5	43.6
Ring 3.	74.0	61.5	2.1	129.0
Ring 4.	84.2	81.8	2.3	188.0
Ring 5.	90.8	87.5	1.8	157.5

Total, 518 c.c.
Actual 500: Diff., 3.6%

Localization of Points

Shift of upper end of solder	Shift of lower end of solder	Ring 3
0.65	0.53	0.63

Interpolation	upper end is 0.2 above Ring 3	Found by measurement 0.3
	lower end is 1.0 below Ring 3	1.0
Distance from top to ring on p.	Actual comp. 4.28	Found by measurement 4.40
Distance of bottom to ring on p.	Actual comp. 3.14	Found by measurement 3.20

This table illustrates in detail the method of computation of height of planes, linear, area and volume computations. This is worked out for a target shift of 7.5 cm.

their respective plane areas, giving the computed actual areas of the planes. These are compared in the last column with the cross-section area of the planes measured on the model and are found to be in good agreement.

from the values just found. The mean of two successive areas is then found and listed in the next column, representing the mean area of a small volume element. The thickness of these elements as found by the distance between the planes is then listed.

The product of the mean area of the element into its thickness gives the volume of the element. The sum of the elements gives the total volume of the region studied. This shows good agreement with the true

from surface landmarks near the plane of the points studied. This is illustrated in the last part of Table II which shows localization to the top and bottom point of the embedded solder. These points lie

TABLE III
Target Shift 15 cm.

Level	Shift b.	Shift p.	h. from p.	h. from b. comp.	h. actual
Top	1.72	2.12	9.9	7.8	7.9
Ring 1.	1.67	2.07	9.7	7.6	7.9
Ring 2.	1.26	1.66	8.0	5.9	6.1
Ring 3.	.84	1.24	6.1	4.0	4.0
Ring 4.	0.39	.79	4.05	1.95	1.90
Ring 5.	0.0	.40	2.1	0.0	0.0

Determination of Linear Dimensions

Level	Dia. on p.	Comp. actual dia.	Actual dia.
Ring 1.	3.90	3.42	3.50
Ring 2.	8.78	7.90	7.90
Ring 3.	10.44	9.67	9.75
Ring 4.	10.78	10.22	10.50
Ring 5.	11.00	10.72	10.75

Determination of Area of Planes

Level	Area on p.	Comp. actual area	Actual area
Ring 1.	12.0	9.3	9.6
Ring 2.	60.4	49.0	49.0
Ring 3.	85.0	74.0	74.3
Ring 4.	92.0	83.0	90.8
Ring 5.	95.0	90.2	90.8

Determination of Volume

Level	Comp. area	Mean area of element	Comp. thickness of vol. element	Vol. of vol. element
Top	0	0	0	0
Ring 1.	9.3	4.6	0.2	0.9
Ring 2.	49.0	29.2	1.7	49.5
Ring 3.	74.0	61.5	1.9	116.8
Ring 4.	83.0	78.5	2.1	165.0
Ring 5.	90.2	86.6	1.9	164.1

Total, 496.3 c.c.
Actual 500: Diff., 0.7%

Localization of Points

Shift of upper end of solder	Shift of lower end of solder	Ring 3	
1.32	1.00	1.24	
Interpolation	upper end is 0.35 above Ring 3		Found by measurement 0.3
	lower end is 1.1 below Ring 3		1.0
Distance from top to ring on p.	Actual comp.		Found by measurement 4.40
4.68	4.30		
Distance of bottom to ring on p.	Actual comp.		Found by measurement 3.20
3.00	2.82		

This table is the same as Table II but worked out for a shift of 15 cm.

volume. It is felt that the use of this method would be applicable for studying changes in volume of the sella, abscesses, and bone tumors.

The localization of points in the object can be determined from co-ordinates of the marker on the base or, more accurately,

on either side of the level of Ring 3, having a shift of 0.65 and 0.53, while the ring has a shift of 0.63. Interpolating from Table I, it is seen that the upper end of the solder lies 0.3 cm. above the plane of Ring 3, while the lower end lies 1.0 cm. below it. On the x-ray film the distance of the ends

of the solder to the nearest approach of the ring was then measured and found to be 4.55 and 3.27 for top and bottom, respectively. These values were multiplied by their respective F values as computed from their known heights, h , from Table I, and the results are 4.28 cm. and 3.14 cm., respectively. These results are found in good agreement with 4.40 and 3.20 as measured on the model. There is a slight error introduced by the fact that the planes of the top and bottom of the solder are not the same as the level of Ring 3. This error is small and it becomes nearly zero in films taken with the control beam passing vertically down through the point in question. The same set of computations are outlined in Table III for the same test object, using a target shift of 15 cm.

When it is desired to reproduce a plane sharply by making two exposures on one film, the amount of shift for the film is found from Table I. Suppose a plane height, h , above the plate is to be radiographed. One film is taken with the target at Position 1 and then the target is shifted to Position 2, the shift being one of the three standard shifts. From Table I the expected shift for the image in plane, h , is read off and the plate moved over this distance. Then the second exposure is made. The desired plane will then be exactly superimposed in the film while other planes will not. This is illustrated in Figure 2-C. It was found that best results were obtained if the first radiograph was taken with the target directly above the region to be studied.

It was felt that the publication of Table I and illustrations would be an aid to those

making use of planigraphy for exact measurements. Using a test object the dimensions of which could be accurately determined made it possible to check the accuracy of the method which, considering the possible errors, is quite satisfactory. It is our intention to apply this method to clinical studies and later to make a report of the findings. This preliminary report of the method was submitted with the hope that others could make use of Table I and outlined procedure.

SUMMARY

1. The authors present tables for use in planigraphy from which the necessary mathematical relationships can be read off directly. From this, the height of various planes can be determined for their respective shifts on the plate. Conversely, the degree of shift of the plate necessary for localization of any given plane can be found when it is desired to use the double exposure method.
2. Correction factors are listed to correct for distortion of linear and area relationships produced by divergence of the x-ray beam from the target.
3. The use of the pantograph and planimeter is outlined for the rapid reproduction of plane boundaries, areas, and the computation of volumes.

REFERENCES

- (1) KAUFMAN, JULIUS: Planeography, Localization, and Mensuration: "Standard Depth Curves." *RADIOLOGY*, 27, 168-174, August, 1936.
- (2) Idem: The Planeogram. *RADIOLOGY*, 27, 732-735, December, 1936.
- (3) Idem: Object Reconstruction by Planigraphy: Reconstruction and Localization of Planes. *RADIOLOGY*, 30, 763-765, June, 1938.

PLANIGRAPHY—ITS APPLICATION TO THORACIC DIAGNOSIS¹

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RECENT changes in the concepts of the treatment of pulmonary tuberculosis, associated with the great advances that have been made in thoracic surgery, serve as a challenge to the roentgenologist, who must now, more than ever, diagnose and localize anatomic and pathologic entities within the thorax. One way by which the roentgen diagnostician can meet this challenge is by the application of the principles of body section roentgenography often referred to as tomography, laminagraphy, stratisgraphy, or planigraphy.

Definition.—"Planigraphy is a method of roentgenographic projection of plane sections of solid objects" (8). This can be produced by the opposing excursion of the x-ray tube and the film in parallel planes which results in the blurring out of all detail except that of the images within the stratum of the fulcrum of the two opposed motions (Fig. 1). The amount of blurring depends mostly upon the amplitude and character of this motion (Fig. 2).

History.—The principle was first demonstrated as theoretically possible in a French patent by Bocage (1), dated June 3, 1921.

Most of the early research on the subject has been reported by Continental workers, namely, Vallebona (2), Bartelink (3), Ziedses des Plantes (4), Pohl (5), Grossmann (6), Chaoul (7), and others.

Andrews in his original essay (8) not only described the different technical procedures necessary for body section roentgenography, but also included a careful history of its development. In a later paper (9) he gave full mathematical and physical proof of the practicability of the planigraphic theory.

In this country, Mr. Jean Kieffer (10) was struck by the inability of the usual x-ray examination accurately to demon-

strate pathology in the sternum. With this problem uppermost in his mind, he independently worked out the principles of body section roentgenography and designed an apparatus for its application which he called an "x-ray focusing machine." He applied for a patent in 1929 which was granted in 1934, but it was not until 1937 that Dr. Sherwood Moore (11) made up a working model of Kieffer's apparatus. Therefore, Dr. Moore's name should be linked with that of Andrews as among the first roentgenologists in this country to become interested in the principles and application of planigraphy.

Apparatus.—The apparatus (Fig. 3) used in this presentation has a fixed tube target distance of approximately six feet. The tube and film move on parallel vertical planes with a fixed upward motion of the tube of 31 in., plus an additional side shift of four inches. The cassette carrier and tube are held in rigid association by a long bar. The focal plane of the exposure is changed by shifting the fulcrum on this rod. The amount of the opposite motion of the cassette carrier is partly dependent upon the relative position of the fulcrum to the x-ray tube and film. This particular type of motion is efficient in making planigraphic examinations of the thorax in that the maximum distortion is given the image in a vertical direction which tends to throw the ribs completely out of focus when they are not near the focal plane. On the other hand, the spine and heart shadows, being in the long axis of the motion, are not thrown laterally over the lung-fields. Ziedses des Plantes (4), Andrews (9), and Kieffer (10) have shown that spiral motion is best in obliterating shadows above and below the focal plane, this being particularly true in sectional x-rays of the skull.

Thorax—A Model for Planigraphic Study.—The thoracic cage makes an excellent model for planigraphic study in that

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it is made up of a proportionately radio-transparent medium, the lungs, which are encased in a bony framework of spine, ribs, and sternum, while centrally within the mediastinum lie the heart, great vessels,

the inability of a more exact anatomical differentiation. Planigraphic views often differentiate between bronchus, pulmonary vein, and pulmonary artery (7).

Indications for Planigraphy.—The

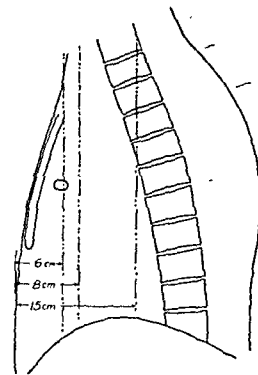
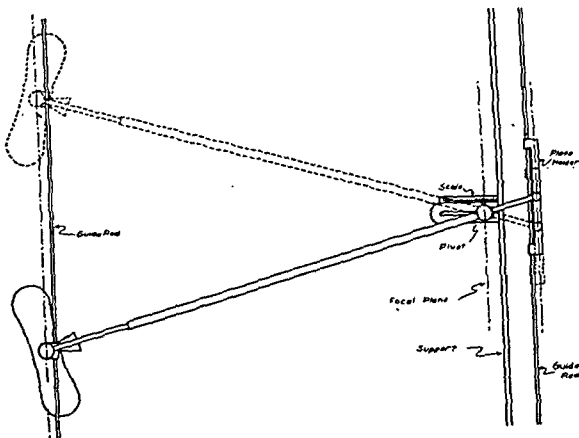
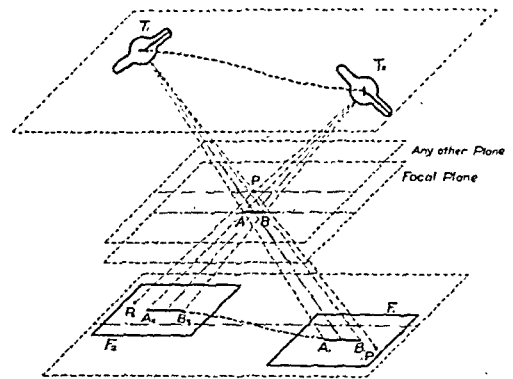
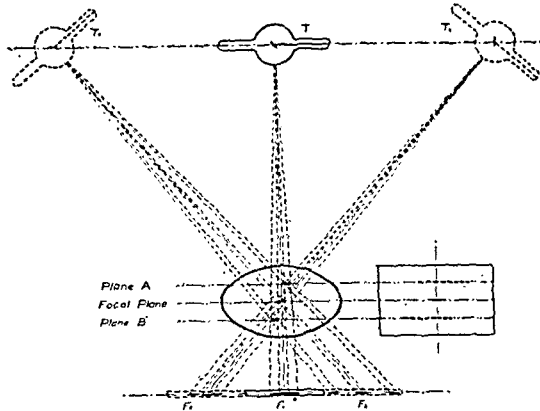


Fig. 1 (upper left). Schematic drawing demonstrating the theory of the planigraphic principle in one plane.
Plane A, above focal plane;
Plane B, below focal plane.

Fig. 2 (upper right). Schematic drawing demonstrating the type of motion used.
 $A_1 - B_1, A_2 - B_2$ —line in focal plane;
 P_1, P_2 —point outside of focal plane.

Fig. 3 (lower left). Schematic drawing illustrating mechanics of the apparatus used.

Fig. 4-A (lower right). Schematic figure, lateral view of chest, demonstrating relative position of bullet in anterior mediastinum with planes of radiography.

nerves, and glands. In the usual x-ray exposure these anatomical parts are superimposed to a varying degree, depending upon the projection of the central beam. Because of this superimposition of shadows, roentgenologists have devised the terms "hilum," "root branch," "peribronchial markings" etc., to make up for

planigraphic film has no more detail than the usual x-ray exposure and added thereto is the accumulated blurring of shadows above and below the desired plane. The examination is of value only provided it has certain advantages over the routine examination, which should consist of more accurate localization, better anatomical

differentiation, and a clearer demonstration of certain pathological entities.

Localization of an opaque foreign body within the mediastinum makes an interesting subject to prove the effectiveness of

the planigraphic principles (Fig. 4-A). Three planigraphic sections of the thorax are shown: dorsoventral with the plane 6 cm. posterior to the anterior chest wall, showing the bullet in focus (Fig. 4-B);

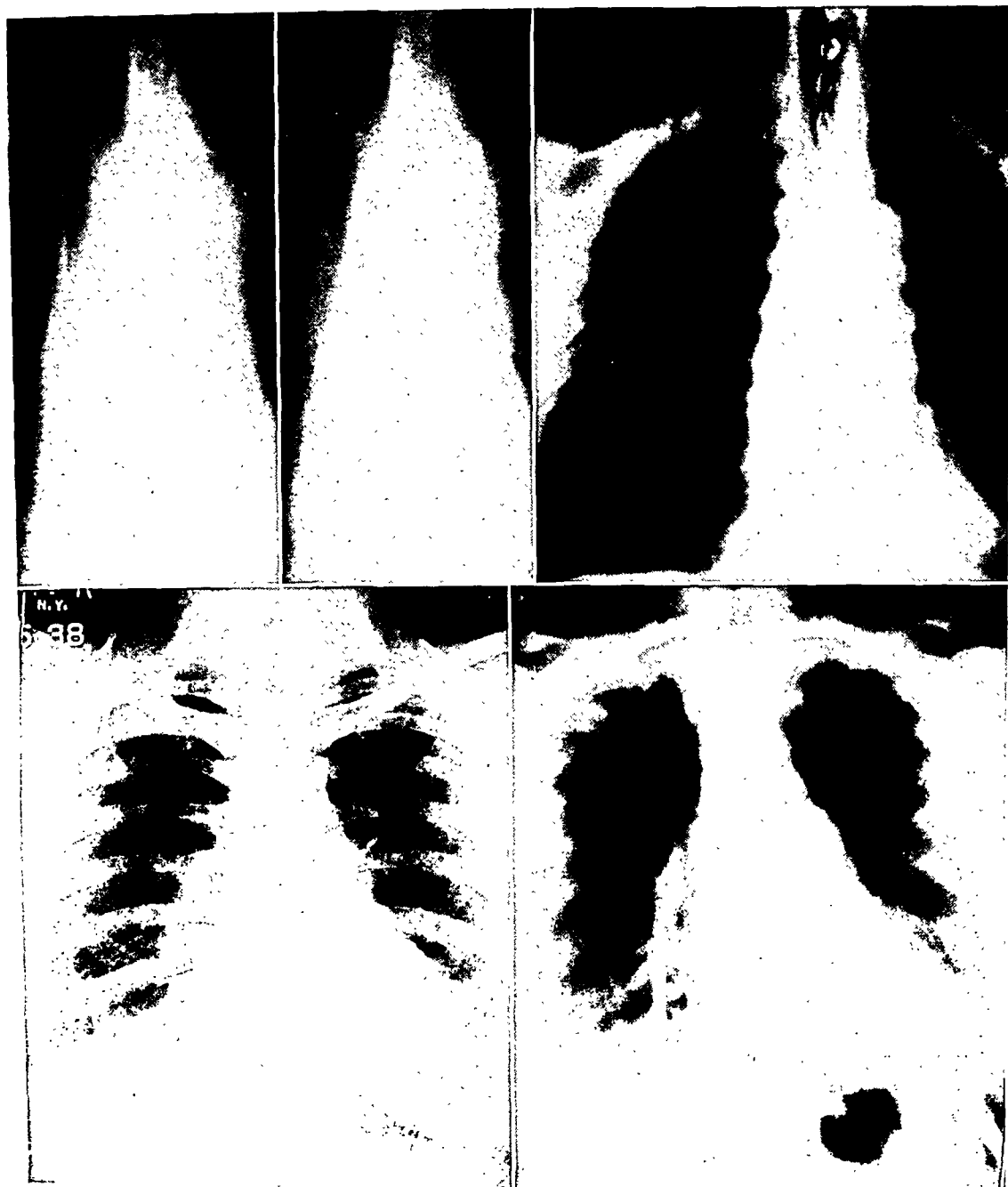


Fig. 4-B (upper left). Planigraph at 6 cm. level; bullet in focus.

Fig. 4-C (upper center). Planigraph at 8 cm. level, 2 cm. posterior to bullet.

Fig. 4-D (upper right). Planigraph at 15 cm. level, 9 cm. posterior to bullet.

Fig. 5-A (lower left). X-ray film.

Fig. 5-B (lower right). Planigraph at 9 cm. level. Two areas of consolidation in right upper periphery, each with central cavity.

dorsoventral with the plane 8 cm. posterior to the anterior chest wall, showing distortion of the bullet shadow from shifting the focal stratum posteriorly by 2 cm. (Fig. 4-C); ventrodorsal with the focal

Mrs. F. R., aged 32 years, whose present illness dates back two years following hemoptysis. Repeated x-ray examinations in many institutions demonstrated no pulmonary pathology (Fig. 5-A). After

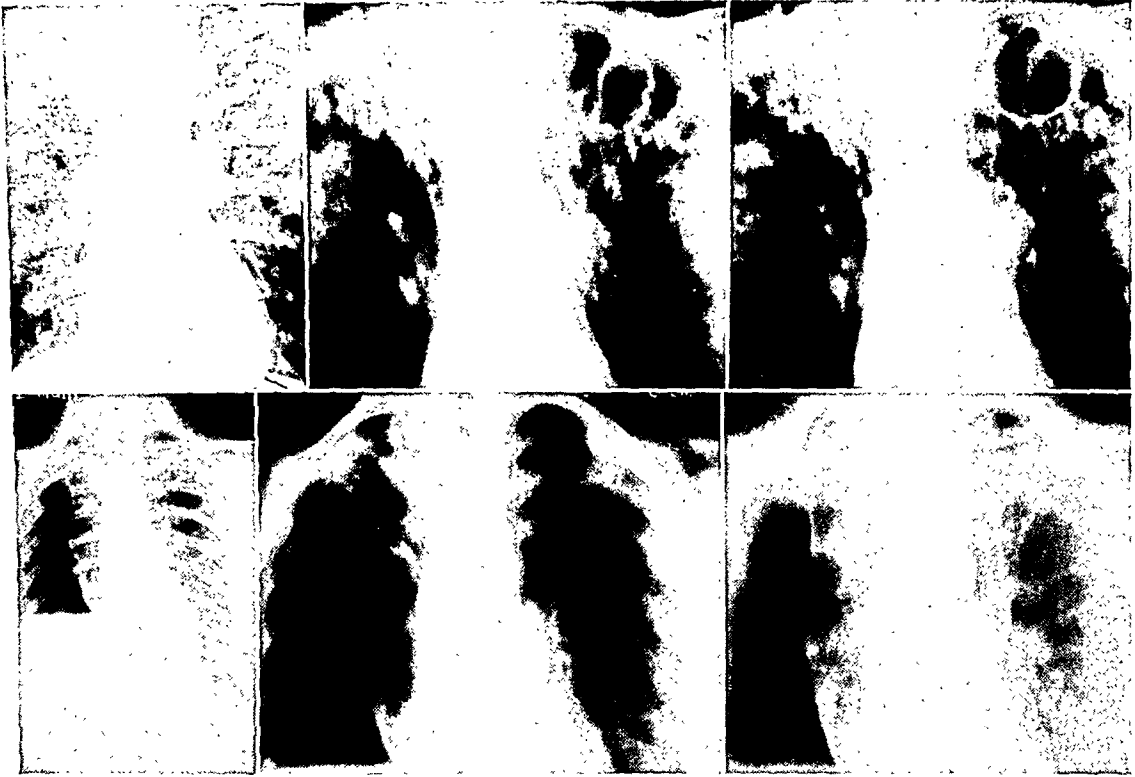


Fig. 6-A (upper left). X-ray film: advanced bilateral pulmonary tuberculosis.
 Fig. 6-B (upper center). Planigraph at 11 cm. level: multiple cavities in left apex.
 Fig. 6-C (upper right). Planigraph at 13 cm. level: large cavity, left apex, in focus.
 Fig. 7-A (lower left). X-ray film: hydropneumothorax right.
 Fig. 7-B (lower center). Planigraph at 8 cm. level. Note interlobar pleural thickening.
 Fig. 7-C (lower right). Planigraph at 12 cm. level. Note cavity, right apex.

plane 15 cm. posterior to the anterior chest wall, showing complete obliteration of the bullet shadow in this plane, some 9 cm. posterior to that of the bullet (Fig. 4-D).

Tuberculosis.—Up to the present time the greatest usefulness of planigraphy has been developed in the field of pulmonary tuberculosis. Its treatment differs greatly if the process is made up of localized productive lesions, or has progressed into extensive fibrotic changes about a hidden cavity. Often most exacting roentgen examinations fail to disclose the true nature of a lesion, as illustrated by the following summary:

a second episode of hemoptysis she was told that she had a lesion in her right lung, although this was not definite. Her right phrenic nerve was crushed in 1936. She then entered a tuberculosis sanatorium where she gained 20 pounds in weight under conservative treatment. Bronchoscopy demonstrated no bronchial ulceration as a cause of persistently positive sputum. In 1938, at a second tuberculosis sanatorium, a small productive lesion 2 cm. in diameter was finally discovered in the right second interspace. A planigraph at 9 cm. disclosed two tuberculous consolidations in the right upper periphery,

each with a small central cavity (Fig. 5-B).

When lesions are bilateral or there is extensive pathology overlying cavities (Fig. 6-A), sectional views tend to bring out the extent of the process and are often instru-

mental in demonstrating unsuspected areas of cavitation (Fig. 6-B). As a result, decision as to the choice of procedure to be carried out in any individual case, must often rest upon the findings of these sectional views (Fig. 6-C), namely, whether the



Fig. 8-A (upper left). X-ray film: thoracoplasty, right.

Fig. 8-B (upper right). Planigraph at 12 cm. level: residual cavity.

Fig. 9-A (lower left). X-ray film demonstrates adhesion from apex to mediastinum.

Fig. 9-B (lower right). Planigraph at 12 cm. level demonstrates level of the adhesion.

patient should be treated by bed rest, phrenectomy, collapse therapy, or thoracoplasty.

After pulmonary collapse, it is often necessary to determine whether all cavities have been compressed, and the following illustration, that of Miss J. I., aged 29

visualized a residual cavity in this area (Figs. 7-B and 7-C).

After thoracoplasty, it is important to determine definitely whether or not the cavity has been compressed. The case of F. H., aged 31 years, who had a pneu-

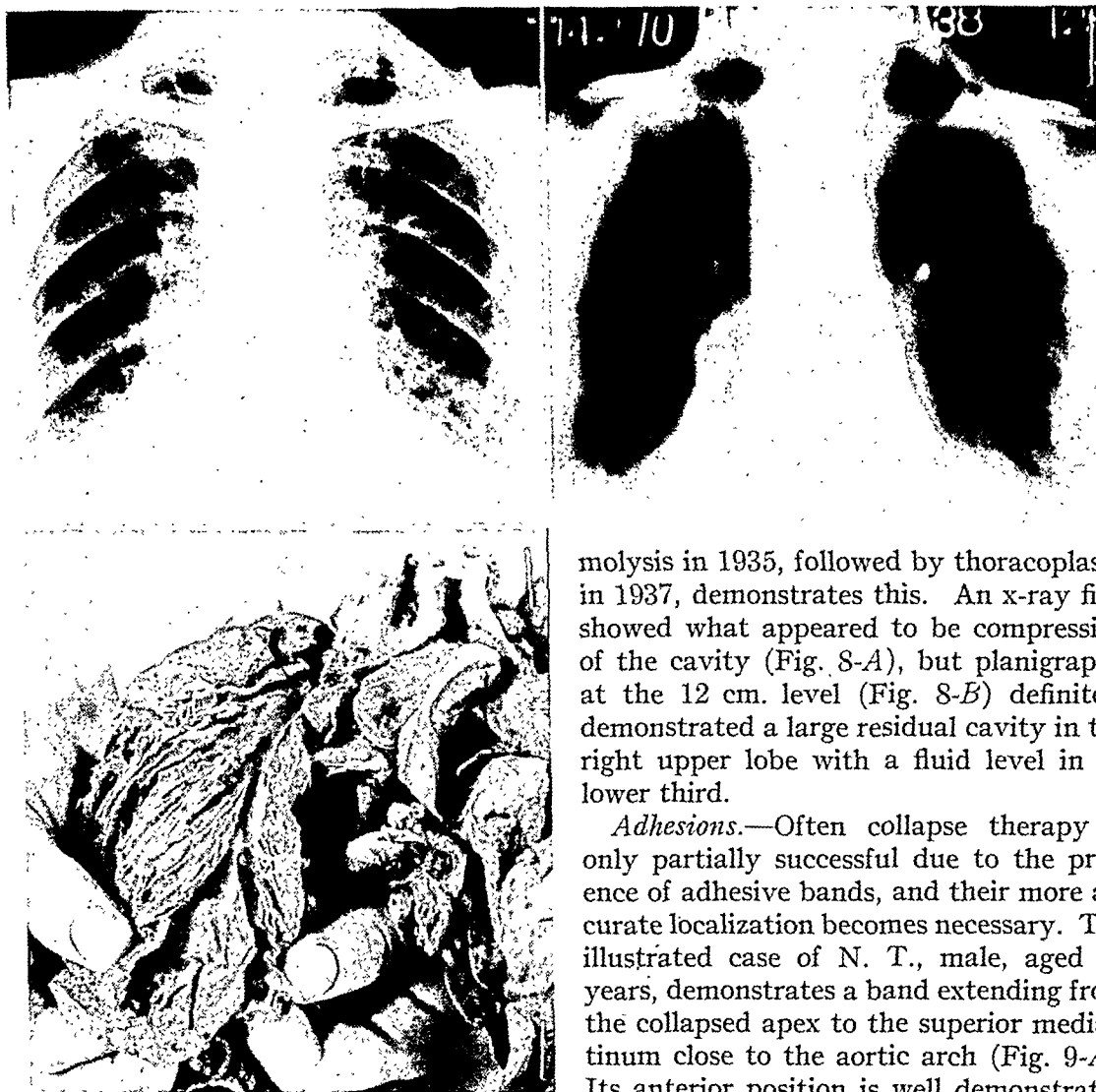


Fig. 10-A (upper left). X-ray film: leukemia; extensive bronchopneumonic consolidations, both bases.

Fig. 10-B (upper right). Planigraph at 12 cm. level, demonstrating elongated cavities, both bases.

Fig. 10-C (lower left). Photograph of lung, demonstrating extensive bronchiectatic dilatations of all lower bronchi.

years, demonstrates high apical pleural adhesions preventing collapse of the apical zone (Fig. 7-A). Planigraphic studies

molysis in 1935, followed by thoracoplasty in 1937, demonstrates this. An x-ray film showed what appeared to be compression of the cavity (Fig. 8-A), but planigraphy at the 12 cm. level (Fig. 8-B) definitely demonstrated a large residual cavity in the right upper lobe with a fluid level in its lower third.

Adhesions.—Often collapse therapy is only partially successful due to the presence of adhesive bands, and their more accurate localization becomes necessary. The illustrated case of N. T., male, aged 23 years, demonstrates a band extending from the collapsed apex to the superior mediastinum close to the aortic arch (Fig. 9-A). Its anterior position is well demonstrated by the planigraphic view at the 12 cm. level (Fig. 9-B).

Bronchiectasis.—It is often difficult to visualize bronchiectasis on an x-ray film without the aid of lipiodol (Fig. 10-A). The following illustration is of a case of lymphatic leukemia complicated by an extensive bronchiectasis. Planigraphy at the 12 cm. level clearly demonstrates elongated cavities with slightly scalloped edges in

the course of both the right and left lower bronchi (Fig. 10-B). Autopsy disclosed tremendous bronchiectatic dilatation of all

of the lower main bronchi, which were partially filled with a thick muco-purulent exudate (Fig. 10-C).



A

B

Fig. 11-A (upper left). X-ray film: large pulmonary tumor.

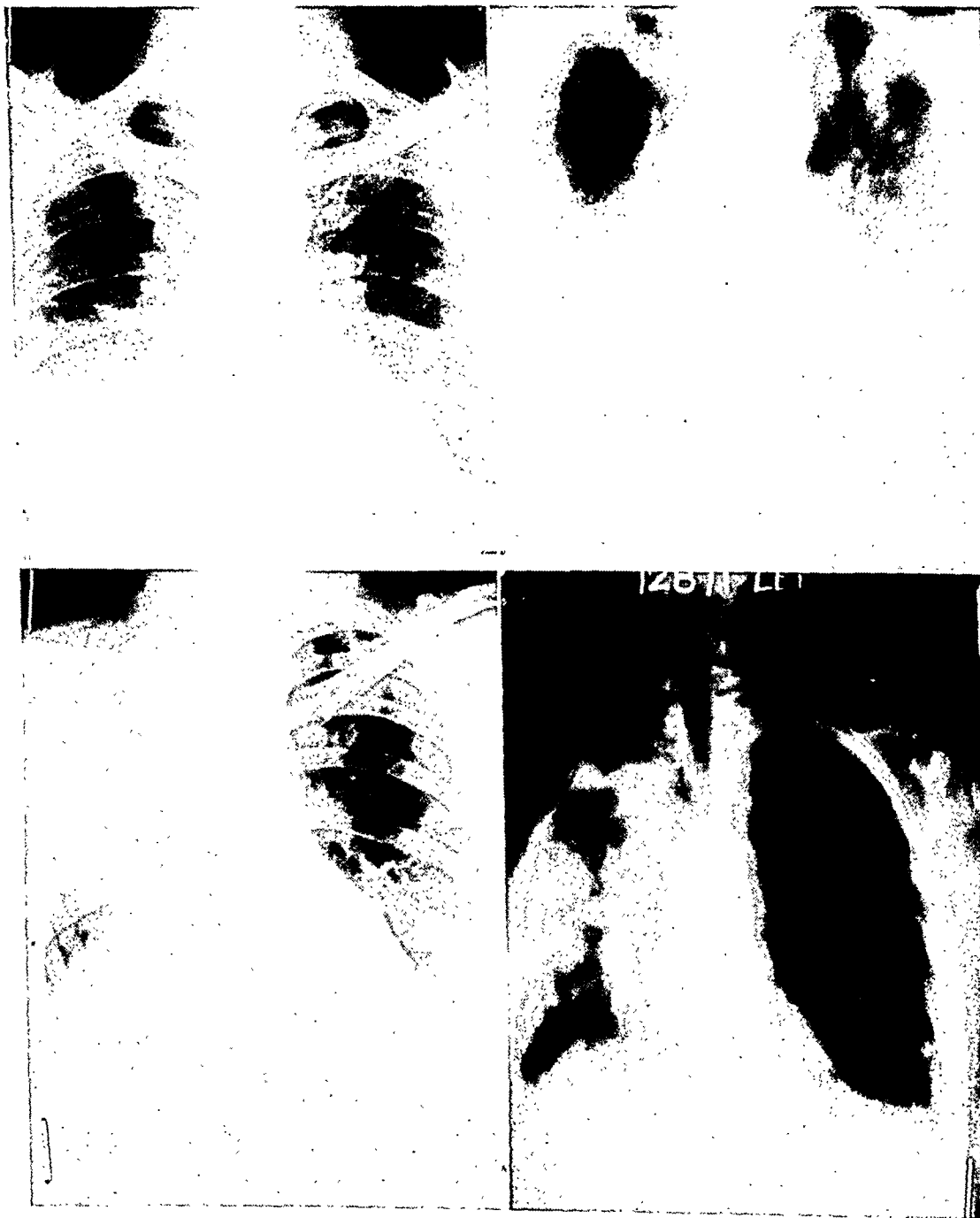
Fig. 11-B (upper right). Planigraph at 8 cm. level, demonstrating occlusion of entering bronchus.

Fig. 12. Metastatic malignancy, Wilms' tumor. (A) X-ray film: large hilar masses, also metastases, right costophrenic angle. (B) Planigraph at 12 cm. level. Note appearance of hilar glands and metastases.

Tumors.—Planigraphy not only aids in more accurate localization of tumors, but has helped in determining the rate of growth or diminution in size at given levels. One case of a large pulmonary tumor (Fig.

11-A) is included to demonstrate the abrupt interruption in the course of the entering bronchus (Fig. 11-B).

Metastatic Malignancy.—Sectional views not only bring out metastatic lesions not



A

B

Fig. 13 (upper). Sarcoma primary in right popliteal space. (A) X-ray film, demonstrating metastases in lung-fields. (B) Planigraph at 10 cm. level, demonstrating lung metastases.

Fig. 14 (lower). Carcinoma of the breast, post-radiation. (A) X-ray film: pleural pulmonitis, right. (B) Planigraph at 12 cm. level, demonstrating distortion of tracheo-bronchial tree.

therapy to the chest and the development of pleural pneumonia, the amount of fibrosis, atelectasis, and pleural thickening may result in such density that detail by ordinary methods becomes impossible. This is best illustrated in the case of Mrs. I. M., aged 46 years, who received extensive pre- and post-operative radiation therapy for carcinoma of the right breast (Fig. 14-A). The planigraphic view at the 12-cm. level clearly outlines the tracheobronchial tree (Fig. 14-B).

Superior Sulcus Tumor.—A case of left superior sulcus tumor is included. The patient was A. K., aged 81 years, whose chief complaint was severe pain extending down the left arm. The mass, though sharply demarcated, was so obscure on the ordinary film (Fig. 15-A), that it was entirely overlooked on a previous routine x-ray examination. Planigraph clearly demonstrates the tumor and its relationship to the lung apex (Fig. 15-B).

Superior Mediastinal Tumor.—One case of superior mediastinal tumor is shown—a proven carcinoma of the thyroid (Fig. 16-A). The patient was Mrs. L. F., aged 53 years. The planigraph demonstrates most clearly the encroachment of the tumor mass upon the intrathoracic trachea, and the miliary metastases in both lower lung-fields (Fig. 16-B).

Rib Tumor.—The rib tumor (case of E. B., aged 16 years), is certainly shown in greater detail on the Bucky film (Fig. 17-A). On the other hand, the large pendulous mass and its relation to the other thoracic structures is better demonstrated on the planigraphic films (Figs. 17-B and 17-C). The pneumothorax about this tumor was produced in an attempt to needle biopsy the mass.

Sternal Pathology.—Metastatic involvement of the manubrium is always difficult to interpret on the flat film (Fig. 18-A). A lateral planigraph, taken near the mid-line, shows how the mass involves the sternum in its upper internal aspect (Fig. 18-B).

SUMMARY

The history, definition, and technic of planigraphy are summarized.

The application and indications for planigraphy in the roentgen study of the thorax are discussed.

Planigraphic principles are demonstrated by the localization of a foreign body in the anterior mediastinum.

Indication for sectional x-ray studies of the thorax are discussed in conjunction with tuberculosis, pleural adhesions, bronchiectasis, lung tumor (primary), metastatic lung tumor, pleural pneumonia, superior sulcus tumor, superior mediastinal tumor, rib tumor, and sternal pathology.

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BIBLIOGRAPHY

(1) BOCAGE, A. E. M.: French Patent No., 536464, 1922.

(2) VALLEBONA, A.: A Modified Technic of Roentgenographic Dissociation of Shadows Applied to the Study of the Skull. *Radiol. med.*, 17, 1090-1097, September, 1930. *Abs. in RADIOLOGY*, 17, 647, September, 1931.

(3) BARTELINK, D. L.: *Nederl. tijdschr. v. geneesk.*, 76, 23, 1932.

Idem: Method of Obtaining Clear Pictures of a Limited Area by Blocking out Superfluous Parts. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 47, 399-407, April, 1933. (Swiss Patent No. 155930, 1932.)

(4) ZIEDESSES DES PLANTES, B. G.: A Different Method for Making Roentgenograms of the Skull and Spinal Column. *Nederl. tijdschr. v. geneesk.*, 75, 5218-5222, Oct. 17, 1931.

Idem: A New Method of Differentiation in Roentgenography (Planigraphy). *Acta Radiol.*, 13, 182-191, 1932.

Idem: Planigraphy: A Method of Obtaining a Clear Image of an Object of Any Desired Plane. *Jour. de radiol. et d'électrol.*, 18, 73-76, February, 1934.

(5) POHL, E.: Imperial German Patent No. 544200 (1927-1932) and Switzerland, No. 155613 (1930-1932).

(6) GROSSMANN, G.: Tomography I and II. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 51, 61-88; 191-209, January and February, 1935.

(7) CHAUL, H.: A New Roentgenographic Procedure in Lung Diagnosis: Roentgenograms of Sections of the Lungs (Tomography). *Deutsche med. Wchnschr.*, 61, 700-703, May 3, 1935.

(8) ANDREWS, J. ROBERT: Planigraphy. *Am. Jour. Roentgenol. and Rad. Ther.*, 36, 575-587, November, 1936.

(9) ANDREWS, J. ROBERT, and STAVA, R. J.: Planigraphy. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 145-151, July, 1937.

(10) KIEFFER, JEAN: U. S. Patent No. 1954321 (1929-1934).

Idem: The Laminagraph and its Variations: Applications and Implications of the Planigraphic Principles. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 497-513, April, 1938.

(11) MOORE, SHERWOOD: Body Section Roentgenography with the Laminagraph. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 514-522, April, 1938.

MYOSARCOMA OF THE STOMACH

REPORT OF TWO CASES

By LEWIS G. ALLEN, M.D., and P. E. HIEBERT, M.D., *Kansas City, Kansas*

THE diagnosis of a gastric malignancy of the carcinomatous type is made with fair ease and accuracy, with the facilities and methods of procedure now at hand in the examination of the stomach. This statement, however, cannot be made regarding the sarcomatous gastric lesion. The explanation for this fact is, no doubt, due to the infrequent occurrence of gastric sarcoma and the various types of involvement of the stomach wall, as well as the distribution of the lesion in the stomach.

The literature of sarcoma of the stomach begins with a case report by Bruch (2) in 1847, followed, in 1862, by a report of two cases of myosarcoma of the stomach by Virchow (12). John Douglas (4), in a study of the literature, found 230 cases up to 1920. In a more complete report, D'Aunoy and Zoeller (3) found 335 cases up to and including 1929. From 1929 to 1936, Glenn and Douglas (7) found 36 additional cases reported, bringing the total to 371. From 1936 to the present, 12 additional cases appear in the literature, bringing the grand total to 385, including the two cases reported herein.

Ewing (6) states that sarcoma of the stomach constitutes about 1 per cent of the gastric malignancies. Masson (10), at the Mayo Clinic, reports 13 cases in 2,067 gastric malignancies. Pack and McNeer (11) report five cases of sarcoma of the stomach in 400 malignant gastric lesions. These figures agree fairly well with Ewing's statement.

Various estimates of the frequency of myosarcoma have been made. Lubarsch (9) believes 16 per cent of all sarcomatous lesions of the stomach are myosarcoma. D'Aunoy and Zoeller (3), in their report of 335 cases of gastric sarcoma, in which a complete histologic study was made of 100, classified 8 per cent as myosarcoma. Bal-four and McCann (1), in a report of 54 cases,

found 6.7 per cent myosarcoma. That the correct percentage is near an average of these figures is indicated by a comparison of the total number of reported cases of sarcoma of the stomach with the number of myosarcomas reported, which gives the incidence of myosarcoma to be 11.4 per cent. Hence, it would appear that approximately one in a thousand malignant lesions of the stomach is a myosarcoma.

Edwards and Wright (5), in a review of the literature, found 38 cases of myosarcoma reported up to 1933. Since that time, a review shows four additional cases have been reported, so that, including the two cases reported herein, it would appear that a total of 44 cases are on record.

The myosarcomatous lesions of the stomach are frequently similar histologically to the spindle-cell sarcoma, the neurosarcoma and the fibrosarcoma. Frequently, two types of cells are represented in one lesion. The muscle cells may contain a considerable amount of hyaline and thus simulate the cells of a fibrosarcoma. Ewing (6) explains that it is not unusual to find cells of neural origin in a myosarcoma, as was true in Case 2 herein. Myosarcoma has been found in all portions of the stomach; on the greater curvature as well as on the lesser, at the pylorus and pars media but rarely in the cardia. In its relation to the stomach wall, it may be endogastric (submucosal), intramural, or exogastric (subserosal). The tumor itself may be pedunculated or sessile.

Ulceration or central degeneration of the tumor may lead to hemorrhage in the endogastric or submucosal type of lesion.

A study of the gross pathology convinces one that a typical roentgenologic appearance should not be expected. That it will be difficult and at times impossible to differentiate the lesion from a carcinoma is also true, though, as Kessler (8) points

out, smoothness of contour of the tumor should suggest sarcoma and he advises that sarcoma should be considered when a tumor is found on the greater curvature, particularly if the typical saucer-shape deformity of carcinoma at this site is lacking.

The endogastric, pedunculated or sessile, tumor generally has a round form, the borders of which may be smooth or ulcerated. The adjoining walls are not infiltrated and there is a relative mobility of the tumor in regard to the gastric wall. If the tumor is pedunculated, there may be a persistent notch corresponding to the implantation of the pedicle. There is, as a rule, little or no interference with peristalsis. The sessile type of tumor on the greater curvature stomach wall is usually convex in contrast to the crescentic deformity of carcinoma of the stomach.

The exogastric, sessile or pedunculated, sarcoma of the stomach produces a smooth, regular, extrinsic filling defect of the stomach or a compression of the neighboring abdominal organs. A cone of contraction at the site of the pedicle may be found, and, when the tumor is manipulated, the effect on the gastric wall is demonstrated. Mucosal ulcerations are rare; central degeneration and necrosis of the tumor may lead to ulceration.

The intramural type of involvement of the stomach wall, which rarely occurs, is truly infiltrative and produces no deformity, not unlike a carcinomatous lesion.

The two case reports which follow are representative as to tumor type of the endogastric myosarcoma and an exogastric neuromyosarcoma. In the latter case there was calcification of the tumor mass which we believe, from our study of the literature, to be a singular finding.

Case 1. C. M. J., a patient of Dr. C. C. Nesselrode, white male, aged 28, had as chief complaints weakness, hematemesis, and nausea. The family history was negative. Of interest in the past history was the fact that eight months before the present illness, while the patient's stomach was empty, he ate persimmons and shortly

thereafter drank water before eating any other food.

The onset of symptoms was seven months prior to his admission to the hospital, with increasing fatigue, pallor, and tarry stools. The patient was somewhat short of breath on exertion but had a good appetite and complained of no discomfort nor pain of any type. These symptoms gradually subsided. On Feb. 17, 1937, his employer sent the patient to his physician because of pallor, and his hemoglobin was found to be 25 per cent (Sahli). Hospitalization was advised. After hospitalization, symptoms of hematemesis, epigastric distress, marked general weakness, repeated vomiting, and abdominal tenderness appeared.

Physical examination revealed a pale, weak, dehydrated, white male, about 30 years of age, lying in bed in apparent comfort. The temperature was normal, pulse 90, and respiration 22. The lips and tongue were almost white and the sclerae were unusually pale. The pupils were regular, equal, and reacted to light. There was a marked oral sepsis. There were no heart murmurs; neither were there any râles nor areas of dullness over either lung-field. An area of tenderness and rigidity was present in the hypogastrium. No masses were palpable; no adenopathy nor abnormal reflexes were found.

Laboratory report: Hemoglobin (Hayden-Hauser), 25 per cent; red blood cells, 2,500,000; white blood cells, 6,900. Differential: Polymorphonuclear, 26 per cent; lymphocytes, 30 per cent; eosinophiles, 1 per cent. Wassermann, negative.

Roentgenographic examination revealed the chest fluoroscopically negative. A rounded negative shadow, about the size of a small lemon, was seen in the dependent portion of the stomach. The mass producing the negative shadow was fairly hard to palpation, could be displaced with some difficulty, and gave the definite impression of an intraluminary filling defect (Fig. 1). The duodenal bulb showed no deformity and no definite ulceration of the stomach wall was seen. Because of the history of

the recent severe gastric hemorrhage and the poor condition of the patient, cautious palpation was practised.

shaped resection and the abdomen was closed without drainage.

The pathologist reported an oval-shaped



Fig. 1. Roentgenogram of stomach (Case 1) showing intraluminal defect.

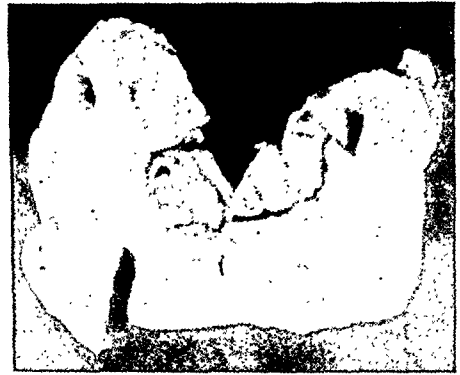


Fig. 2. Photograph of tumor (Case 1) showing the two areas of ulceration.

Correlating the clinical symptoms with the above roentgenographic findings, it was thought that the mass could be best explained as either a phytobezoar of the persimmon type or a neoplasm of the greater curvature of the gastric wall. Further examination was planned when the patient's condition would permit more satisfactory examination. However, the hematemeses continued and the patient's hemoglobin had been elevated only slightly by three blood transfusions in seven days. Therefore, it was deemed inadvisable to postpone laparotomy.

At operation, under local anesthesia, a puckered scar on the anterior surface of the stomach near the greater curvature and about three inches proximal to the pyloric ring was found, which was the base of the palpable, movable, intraluminal mass (Fig. 2). No adenopathy in the surrounding tissue nor masses in the liver were apparent. The tumor was removed by a V-

submucosal tumor which measured 4.5 by 3.5 cm. There were two medium-sized areas of ulceration of the mucosa covering the tumor (Fig. 3). A histologic diagnosis of myosarcoma was made.

The patient's post-operative recovery was uneventful with the exception of a thrombophlebitis on the sixth post-operative day. He was dismissed on the thirteenth post-operative day. For a period of 17 months he has gained weight, worked daily, and has had no gastric disturbance of any type.

Case 2. Q. P. B., a patient of Dr. J. F. Hassig, aged 69, white male, had complaints of weakness, pallor, and vomiting of blood. The family history was essentially negative. Of note in the past history was the fact that for several years the patient had noted a progressive anemia, pallor, increasing fatigue, some nervousness, but no pain nor discomfort. About two weeks after the initial symptoms he consulted his family physician who noted the pallor but found no other abnormal physical findings. The hemoglobin determination was 45 per cent and the red blood cells, 2,600,000.

Two days following the above examination, on May 17, 1936, while eating noon-day lunch, the patient fainted, following which he vomited several times and each

time the vomitus contained a large amount of blood. The total quantity of blood lost was estimated at about 1000 c.c. The

acidity to be 56° and the free hydrochloric acid 43° .

Roentgenological examination, on June

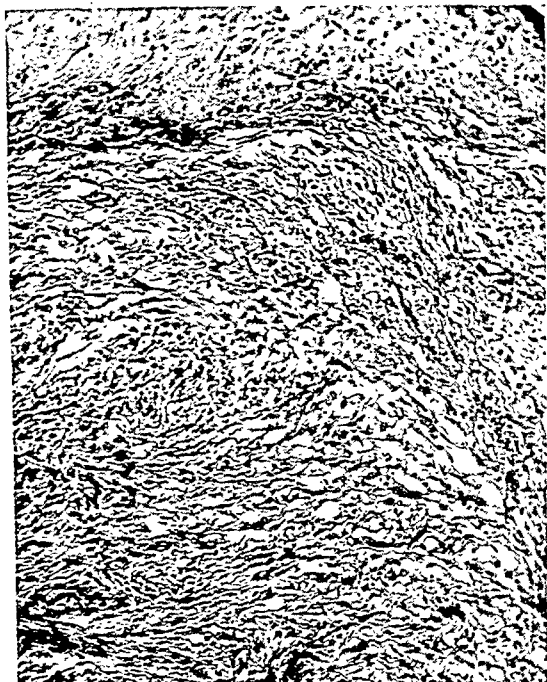


Fig. 3. Photomicrograph of tumor (Case 1). Diagnosis, myosarcoma.

patient grew weaker and was definitely dyspneic, cold and clammy, and dizzy, and was removed to the hospital.

After hospitalization, physical examination revealed a white male, aged 69, good nutrition, extremely pale, obviously in shock but complaining of no definite pain or discomfort. The eyes reacted to light and accommodation, the heart and lungs were essentially negative to examination, and the blood pressure was 110/60. The abdomen showed a good muscular tone but no masses were palpated; neither was there any evidence of tenderness or rigidity. The liver was not palpable and there were no abnormal reflexes nor adenopathy of any type. The laboratory report: Hemoglobin, 27 per cent; red blood cells, 2,150,000; white blood cells, 9,500. Wassermann, negative; urine essentially negative. Gastric analysis showed the total gastric



Fig. 4. Roentgenograms of stomach (Case 2) showing inconsistent radiographic appearance of the prepyloric area.

8, 1936, showed the chest fluoroscopically negative. Stasis in the lower esophagus was demonstrated, the media rising and falling with respiration. Canalization of the stomach was tardy. An irregularity of the pyloric antrum was demonstrated, presenting what appeared to be a diffuse gastropasm with a bud-like extension of the media posterior to the pyloric antrum. The findings were confusing.

The patient was re-examined on the following day; the contracted pyloric antrum was visualized but an ulcer crater was not demonstrated. Peristalsis over the pyloric antrum was interrupted and confusing in detail. The deformity varied in its appearance from that seen previously, the bud-like shadow presenting a different relationship.

One week later, the stomach was again examined. In the interval, belladonna to subphysiological effect had been administered. At this time, there was a 25 per cent residue in the stomach while previously

there had been no six-hour remainder. There was an easily palpable, rounded tumor which moved with respiration and

moderately dilated, and there was moderate thickening of the walls of the stomach. A tumor mass about the size of a



Fig. 5.

Fig. 5. Photograph of tumor (Case 2); metric rule indicates size.

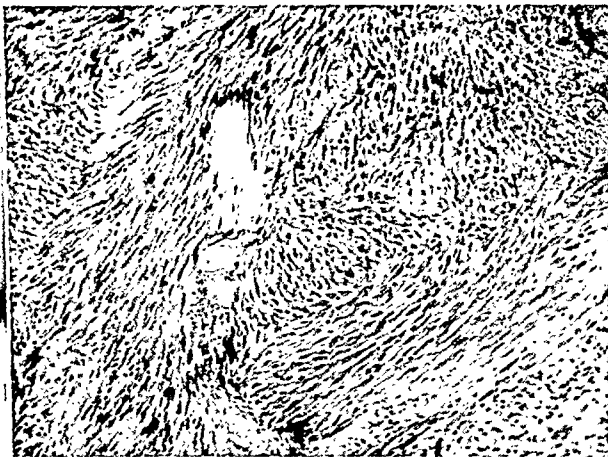


Fig. 6.

Fig. 6. Photomicrograph of tumor (Case 2). Diagnosis, neuromyosarcoma.

gave the impression of being located behind the pyloric antrum. This mass was difficult to feel when the stomach was filled. It appeared to be definitely more anterior than the kidney and offered the impression of originating outside the stomach. The mass appeared too low to have its origin in the gall bladder. Repeated roentgenograms showed the pyloric end of the stomach inconsistently irregular with the shadow of the incomplete duodenal bulb superimposed on the irregularity (Fig. 4). Roentgenologically, the following were considered the most probable: (1) Carcinoma of the pancreas with secondary involvement of the posterior gastric wall; (2) peptic ulcer with bizarre infiltration, and (3) carcinomatous infiltration secondary to gastric polyposis.

The patient remained at the hospital for a period of about a month, during which time he received a number of blood transfusions and regained considerable strength. He had no symptoms referable to his stomach, had a good appetite, and felt fairly well.

On June 18, 1936, an exploratory laparotomy was done, the stomach was found

large orange, attached by a narrow base to the anterior wall of the stomach just proximal to the pylorus, was found (Fig. 5). The point of attachment of the tumor encroached upon the pylorus. It varied in color and had a bosselated appearance. No definite metastasis nor enlargement of the lymph nodes was found. The tumor was resected in the long axis of the stomach, the resection including a portion of the pyloric ring. The stomach and abdomen were closed, including two properly placed drains.

The tumor weighed 124 grams and measured $8 \times 6 \times 4.8$ cm. The tissue was well encapsulated by a smooth glistening membrane. The end of the tumor attached to the stomach wall showed the mucosa thinned and in the central portion was an ulceration that led into a sinus tract in the central portion of the tumor (Fig. 6). The histologic diagnosis was an infected neuromyosarcoma of the stomach, showing considerable hyaline degeneration and calcification. The calcification of the tumor explained the changing roentgenographic picture and confusion, when interpreted, as due to opaque media (Fig. 7). (As an

afterthought, a preliminary scout film would have been helpful.)

The post-operative course was rather

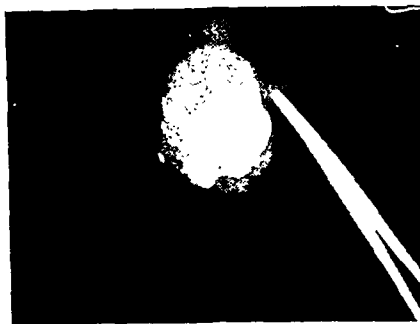


Fig. 7. Roentgenogram of tumor (Case 2) showing calcification.

stormy, with some abdominal distention, fever, pain, etc., but the patient recovered and left the hospital in comparatively good health one month after the operation.

About three months later, the patient returned to the hospital, at which time he had a rather marked secondary anemia and a definite localized empyema of the right lung. This was treated by aspiration and the patient recovered without further complications.

At the present time, approximately two years after operation, the patient is in excellent physical condition, has gained considerable weight, has no abdominal symptoms, works daily, and shows no evidence of recurrence.

SUMMARY

1. A study of the literature shows that

385 cases of sarcoma of the stomach have been reported. Of these, 44 cases were myosarcoma.

2. The characteristic roentgenologic features of myosarcoma are discussed.

3. Two case reports of gastric myosarcoma are given, Case 1 being an example of the endogastric type of lesion and Case 2 an example of the exogastric type.

4. In Case 2 the tumor showed calcification, which appears to be singular in its occurrence.

REFERENCES

- (1) BALFOUR, D. C., and McCANN, J. C.: Sarcoma of the Stomach. *Surg., Gynec. and Obst.*, 50, 948-953, June, 1930.
- (2) BRUCH, CARL: Die Diagnose der bösartigen Geschwulste. Maim, V. v. Zabern, 1847, quoted by Glenn and Douglas (7).
- (3) D'AUNOY, R., and ZOELLER, ADELAIDE: Sarcoma of the Stomach: Report of Four Cases and Review of the Literature. *Am. Jour. Surg.*, 9, 444-464, September, 1930.
- (4) DOUGLAS, JOHN: Sarcoma of the Stomach, with Report of Three Cases. *Ann. Surg.*, 71, 628-638, May, 1920.
- (5) EDWARDS, C. R., and WRIGHT, R. B.: Myosarcoma of the Stomach. *Am. Jour. Surg.*, 19, 442-445, March, 1933.
- (6) EWING, J.: Neoplastic Disease. Third edition, p. 277. W. B. Saunders Company, Philadelphia, 1928.
- (7) GLENN, F., and DOUGLAS, E.: Sarcoma of the Stomach. *Arch. Surg.*, 33, 467-478, September, 1936.
- (8) KESSLER, EMMA: quoted by Charles A. Waters and Ira I. Kaplan, 1935 Year Book of Radiology, first edition, pp. 208-210. Year Book Publishers, Inc., Chicago, 1935.
- (9) LUBARSCH, O., and HENKE, F.: Handbuch d. spez. path. Anat. u. Hist., Vol. 4, part 3, 1926-1929.
- (10) MASSON: quoted by D. C. Balfour and J. C. McCann (1).
- (11) PACK, G. T., and McNEER, GORDON: Sarcoma of the Stomach. *Ann. Surg.*, 101, 1206-1224, May, 1935.
- (12) VIRCHOW: quoted by C. R. Edwards and R. B. Wright (5).

THE JOINT CHANGES IN HEMOPHILIA¹

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THE fact that characteristic joint changes occur in hemophilia is not generally recognized by the medical profession, including roentgenologists, orthopedists, and surgeons. Quite often these joints are diagnosed as tuberculous or arthritic, and may even go to operation before it is discovered that the patient is a hemophiliac. Even when the patient is known to have hemophilia, the physician may not realize that the joint condition is due to hemorrhages into the joint, but may think it is due to some infection and advise removal of the teeth, tonsils, etc. The fact that we do not see similar cases often is probably the reason such errors are made; however, we must be on the lookout, since failure to diagnose such a case may be fatal to the patient. Key (7), who has written an excellent article on the pathology in hemophilic joints, makes the following statement:

"Consequently, it does not occur to the average surgeon that he may some day open a hemophilic joint under an erroneous diagnosis. This, in spite of the facts that a hemophilic arthritis may closely resemble conditions for which operative intervention is indicated, and that the literature contains several reports of surgical tragedies which resulted from operations upon hemophilic joints under an erroneous diagnosis. Consequently, it is important that surgeons who operate upon joints should know thoroughly the clinical picture of hemophilic arthritis."

There are three recognized types of hereditary bleeding: (1) hemophilia, (2) hereditary hemorrhagic telangiectasia (Osler), and (3) hereditary hemorrhagic diathesis (Hess).

In hemophilia, L. J. Witts (14), *Guy's Hospital Reports*, says:

"The hemorrhagic tendency manifests itself

in early life and the joints are often affected with hemarthrosis. The formed elements and the chemical constituents of the blood, and the walls of the blood vessels appear to be normal, but the clotting of the blood is much delayed, perhaps as a result of some alteration in the physical structure of the plasma. Hemophilia is inherited, by the law of Nasse, according to which it is transmitted only by females and manifested only by males. In Mendelian terminology it is a recessive sex-linked characteristic, and females should be affected in the proportion of 1 to 200 affected males.

"Over thirty years ago Osler separated off from hemophilia the condition of hereditary hemorrhagic telangiectasia. In this disease the hemorrhages come from small naevi in the skin, mucosæ, and the viscera, which are sometimes obvious but on occasion easily overlooked. The blood is normal. The disease affects males and females equally, being transmitted from generation to generation and behaving as a Mendelian dominant.

"In 1916, Hess distinguished a third hereditary hemorrhagic diathesis, a hereditary form of purpura hemorrhagica. In most of Hess's cases the blood platelets were diminished in numbers, and the diathesis presents just those symptoms which we are accustomed to associate with shortage of platelets, however acquired."

According to Davidson and McQuarrie (3):

"... the following factors are normal in hemophilia: blood calcium, fibrinogen, anti-thrombin, thrombokinas, serum proteins, number of blood platelets, blood hydrogen ion concentration, bleeding time, capillary resistance, and clot retractility and toughness."

Patek and Stetson (10), in 1936, state:

"There is a substance in normal blood which in small quantity effectively reduces the clotting time of hemophilic blood,

"In normal plasma rendered free from platelets, whether by filtration or centrifugation, there is a substance which is effective in reducing the clotting time of hemophilic blood. This substance also resides in the plasma of thrombopenic purpura. It is either unavailable or greatly diminished in hemophilic plasma.

"In the clotting of either hemophilic or of

¹ Presented before the Midsummer Radiological Conference, Denver, August, 1938.

normal plasma, hemophilic platelets behave similarly to normal platelets. Filtration prolongs the clotting time of both normal and of hemophilic plasmas, on recalcification. This is due, presumably, to the removal of platelets. However, the addition of filtered normal plasma to whole hemophilic plasma causes a sharp reduction of clotting time on recalcification. This indicates that the clot-promoting substance provided by normal blood resides in the platelet-free plasma. Moreover, the addition of a suspension of normal platelets of the concentration present in normal plasma to whole hemophilic blood causes no change in the latter's clotting time."

Hess (6) says that, "Typical hereditary hemophilia is not associated with a deficiency of calcium."

Others claim that the active principle causing coagulation is in the blood platelets, and because of their lack of fragility, it is not liberated into the plasma.

C. L. Birch (1) states:

"Blood platelets of hemophiliacs have a greatly increased resistance both to hypo- and hypertonic salt solution. When the resistance of hemophilic platelets is overcome mechanically the blood coagulates in normal time."

Apparently a complete solution of the problems entering into hemophilic blood has not been reached.

König's classification of hemophilic joints is generally followed. Quoting from Solis-Cohen and Levine (12):

"König divides the pathologic changes occurring in the joint into three successive phases: (1) hemarthrosis; (2) panarthrititis; (3) the regressive stage.

"(1) Hemarthrosis is associated with thickening of the fibrous joint capsule and is unaccompanied by bone changes.

"(2) In the panarthritic stage definite vacuolization in the epiphysis above the articulating surface occurs, the edges of the latter being sharply etched and well defined. The opposing joint surfaces are separated by a hemorrhagic effusion.

"(3) In the regressive phase the loss by destruction or absorption of cartilage is due to interference with the circulation and results in deformity. Pseudo-lipping is present, suggesting a true osteo-arthritis. True bony osteophytes develop only after the destruction of joint cartilage. Limitation of motion of the affected joint is often associated with regional muscular atrophy."

Doub and Davidson (4) describe the joint changes as follows:

"From the brief review of the roentgen-ray findings, as noted in these seven cases, and in the review of the rather scanty literature on the subject, it would seem that two groups of roentgen-ray signs must be considered, *viz.*, (1) the signs seen in the early cases, or in those exhibiting no destructive change, (2) the signs seen in the advanced cases which exhibit destructive changes.

"In the first group the findings include: (1) Effusion of blood into the joint; this may or may not show calcification. (2) Thickening of the joint capsule. (3) Lipping, similar to hypertrophic arthritis. These changes may or may not be diagnostic, but the presence of a calcified hematoma in a case presenting joint symptoms is strongly suggestive of this condition. In these cases, there is no bone destruction and no cartilaginous involvement. This type of case may suffer repeated attacks of hemarthrosis without the signs progressing beyond this point.

"The findings in the second group are much more distinctive. (1) General or localized cartilaginous destruction. (2) Bone destruction of several varieties, (a) punched-out areas in the epiphysis, with an intact articular surface due to hemorrhage into the epiphysis; (b) destruction of the articular surface, often with localized rounded areas of destruction extending into the epiphysis. (3) Blood clot in the synovial cavity which may become organized, with some calcification. The above signs are characteristic of hemophilic arthritis and when the typical punched-out areas of destruction are seen in conjunction with the organized blood clot the diagnosis can be made without other clinical data."

Rypins (11) states:

".... that widening and deepening of the intercondylar fossa, with or without arthritic changes in the knee joint, in a member of the male sex is characteristic of hemophilia."

Joints Most Commonly Involved.—The most comprehensive list I have seen is that of H. B. Thomas (13), who reports as follows:

"From 1930 to 1935, 98 cases of hemophilia were studied at the Research and Educational Hospital and the Illinois Surgical Institute for Children.

"At the time of the first examination, the ages of the patients ranged from birth to 65 years. Seventy-seven patients (78.5 per cent) gave a history of joint involvement, while 60 (61.2 per cent) had permanent joint deformity.

The percentage of joint involvement is actually much higher than these figures would indicate because in the average case it is a rather late manifestation, and many of these patients are young children who undoubtedly will later develop joint hemorrhage. Of the 65 patients ten years of age and over, 52 (80 per cent) gave a history of joint involvement. Of the joints involved, the knee was by far the most commonly affected (68 per cent). Next in order of frequency were the ankle (56 per cent), the elbow (53 per cent), the hip (16 per cent), and then, more rarely, the small joints—the fingers (15 per cent), the wrist (5 per cent), and the toes (2 per cent). The shoulder seemed to have escaped permanent deformity more than any other joint. The spine was involved in three cases."

Contractions of the arm and wrist, from hemorrhage into the muscles, have been reported. One of our cases had this condition in both the forearm and wrist. Hemorrhages into the hip are reported as very uncommon; however, Thomas reports them in 16 per cent of the cases. Two of our three cases had hemorrhages into the hip. Both were adults, but no changes are shown in the films. When such hemorrhages occur before maturity, they produce changes resembling Perthes' disease.

Regarding involvement of the hip joint, Professor Löhr (8) states:

"A review of the world's literature of definite cases revealed the surprising result that all cases before puberty, with acute heavy hip-joint hemorrhages, showed the roentgenologic picture of a florid Perthes' disease. This condition has been attributed by us to the high sensitivity of the youthful epiphyseal bones to the physical and chemical influences exerted by the hemorrhages.

"On the other hand, the x-ray pictures of the hip joints of adult hemophiliacs show the most diverse changes: now a healed Perthes' condition following hemorrhages in youth, coxa valga formation, bone cyst-like formations in the head and neck of the femur, or in the trochanter, together with a more or less definite arthritis deformans. Hemorrhages into the head of the femur after puberty do not furnish the typical picture of a Perthes-Calvé hip disease."

Brailsford (2) states:

"If the hip joint is involved in young per-

sons, the epiphysis of the femoral head shows somewhat the same fragmentation seen in Perthes' disease. Radiographs showing these changes are used to illustrate the papers of Löhr, König, and Peterson. The degenerative changes may result in a deformity or complete destruction of the femoral head.

"Montanari described a case, aged two, in which the femoral head was completely destroyed."

In spite of the fact that Thomas reports involvement of fingers 15 per cent, wrist 5 per cent, toes 2 per cent, very little damage is done to the small joints, or at least very few reports are made of extensive damage to them.

However, Firor and Woodhall (5) report an unusual case involving the thumb of a hemophiliac, "pseudo-tumor" with bone destruction, which had twice been diagnosed as a sarcoma.

Treatment.—The scope of this paper does not cover treatment in detail. Apparently, blood transfusions are most often used. Placental extract, amniotin, snake venom, vitamin C, foreign proteid shock, and many other substances are used. Firor and Woodhall advise electrocautery in all surgical operations on known hemophiliacs, and suggest that, "There is a favorable influence of cauterization of hemophilic tissue upon reduction of the clotting time."

John C. Otto (9), who gave one of the earliest descriptions (1803) of hemophilia, had a keen perception of the hereditary factor in hemophilia. His article is quoted by many subsequent authors, but I have never seen his method of treatment quoted, and do not know anything about its merits or whether or not it has been used since his day. However, his insistence on its efficiency makes it rather interesting. Otto says:

"A few years since, the sulphate of soda was accidentally found to be completely curative of the hemorrhages I have described. An ordinary purging dose, administered two or three days in succession, generally stops them; and, by a more frequent repetition, is certain of producing this effect. The cases in which the most powerful, and apparently the most appropriate remedies have been used in

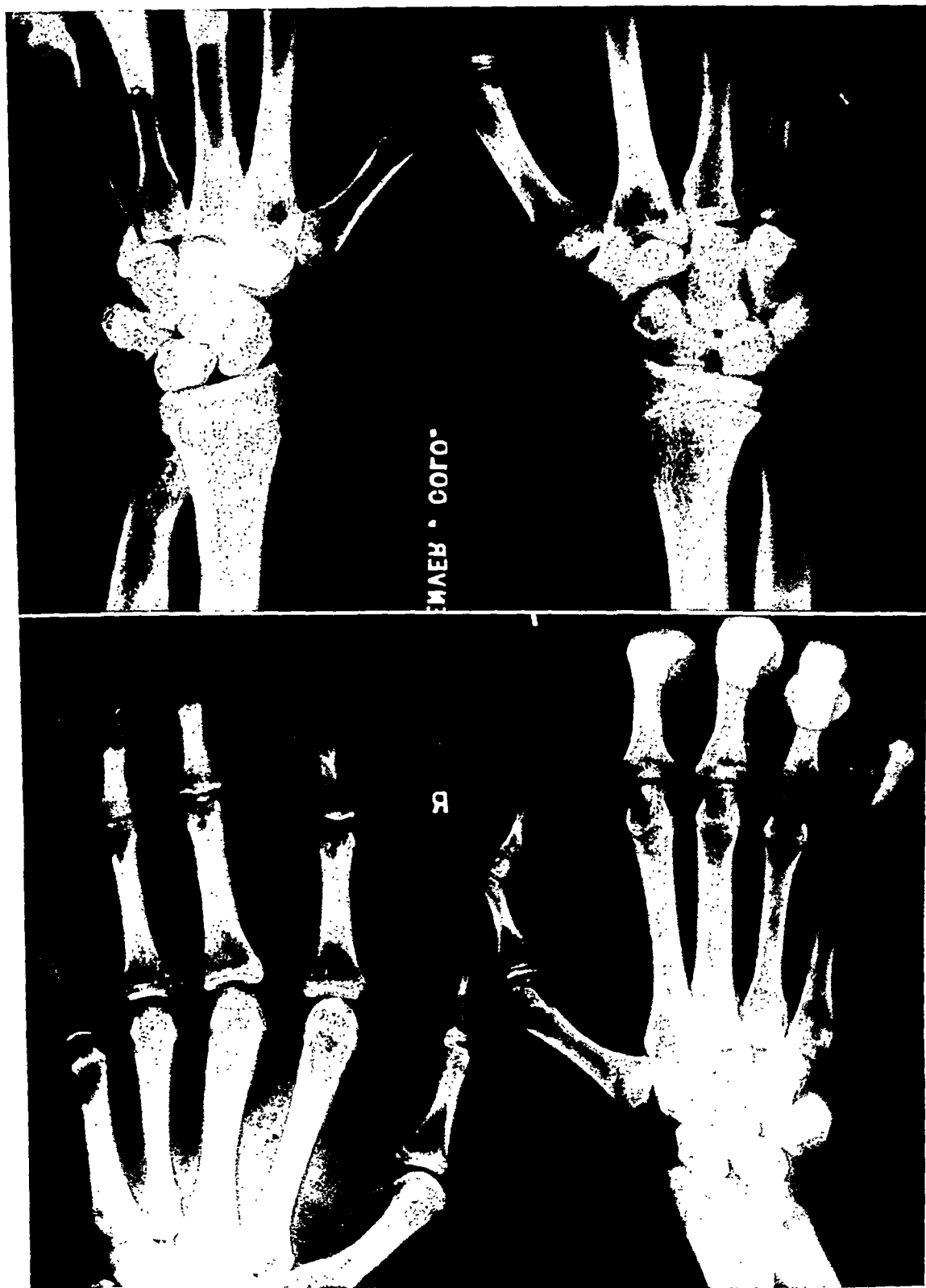


Fig. 1 (*upper*). Case 1. Postero-anterior views of both wrists. In the left, the ulna is shortened and does not articulate with the wrist.

Fig. 2 (*lower*). Case 1. Postero-anterior views of both hands. Note that the left is claw-like. There are no bone or joint changes.

vain, and those in which this mode of treatment has been attended with success, are so numerous, that no doubt can exist of the efficacy of this prescription."

CASE REPORTS

Case 1. *Family History*.—The grand-

3. A daughter who died during pregnancy with "flu." (A, This daughter had one son who died at the age of 17 months from a circumcision, living one week after the circumcision.)

4. A daughter who had the following children: (A, A boy, now 16 years of age,

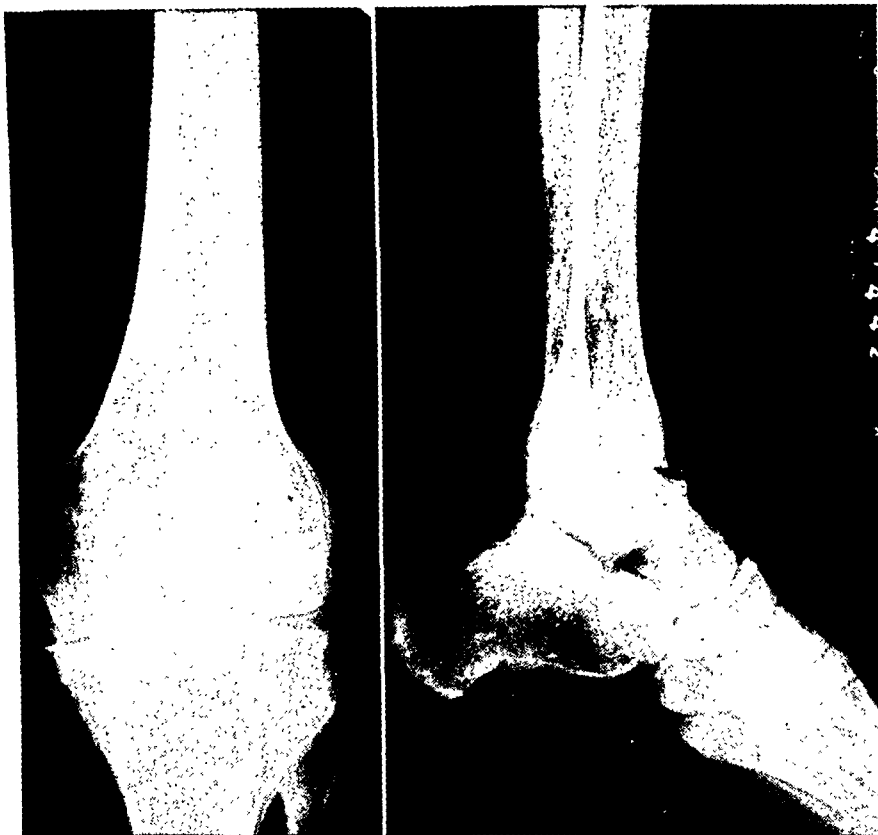


Fig. 3.

Fig. 3. Case 2. Right knee. The intercondyloid notch is deepened and widened, and there is irregularity of the spine. There is a marked absorption of the inner semilunar cartilage.

Fig. 4.

Fig. 4. Case 2. Right ankle. There is absorption of cartilages between the tibia and astragalus, and, also, between the astragalus and os calcis. There is an increase in the density of the bones adjacent to their articulations.

mother of Case 1 states that there was no history of bleeding for three generations preceding her. Four children were born to her.

1. A son, who died at the age of 55, was not a bleeder.

2. A son who died at the age of six years from a tooth extraction, living three weeks after the extraction. He had shown only one previous tendency to bleeding, from a deeply lacerated scalp.

a bleeder [Case 1, reported in detail herein]; B, a daughter, normal; C, a son, born 10 years previously, a bleeder. This boy was circumcised at the age of two months. He was given injections of human blood twice within three days, which stopped the bleeding. He was never affected with swollen joints. He had had three transfusions at various times for injuries in the mouth. He died two years ago from brain concussion caused by falling off his bicycle onto the

curbing. *D*, a son, eight years old, normal. *E*, a son, five years old, normal.)

Personal History.—Age, 16 years. The first signs of the disease appeared when circumcised on the eleventh day; bleeding was stopped after three days by transfusions and injections of various medicines.



Fig. 5. Case 2. Right elbow. There is an enlargement of the head of the radius and of the olecranon process. There are punched-out areas in the olecranon. The lower end of the humerus, head of the radius, and the olecranon process of the ulna show rarefaction.

At the age of seven months, the right shoulder was injured, resulting in pain. An x-ray examination at this time was negative.

During the period between the ages of one and six years, the following instances occurred:

From the time he began learning to walk (at 13 months), until he was 18 months old, he carried large bumps on either side of his forehead from falling while walking.

When two and one-half years old, he

had a very severe attack of tonsillitis, with swelling of the throat and inability to talk. At this time his kidneys did not function, necessitating the use of a catheter. From the date of this illness, he had difficulty in learning, also in keeping his balance. This instability resulted in several falls which caused mouth injuries, requiring injections of blood and medicine to control the bleeding.

At the age of five years, a swelling started in the right elbow, extending to the wrist, then the fingers, also to the shoulder, accompanied by intense pain, which continued for a week or more. At this time the pain subsided, leaving the joints slightly discolored. This discoloration gradually became darker and later turned a yellowish shade. This cleared up in about six weeks, leaving the wrist twisted and the fingers drawn. Olive oil rubs were beneficial, but if the joints were forced the swelling appeared again. The wrist has remained stiff, but with the exception of the third and fourth fingers, which are still slightly affected, the other fingers have straightened.

The patient had a similar spell with the left arm at the age of eight years, leaving the wrist twisted and stiff and the fingers drawn; however, he can grasp objects with his left fingers.

On two or three occasions, he has had a swelling of the right ankle with severe pain, resulting in turning in of the foot, but the joint has not stiffened.

At the age of 13 years, he slipped and fell, severely injuring his left knee. The knee was stiff for a year, gradually returning to normal. In the last ten months, he has had two similar falls, again weakening this knee. It is improving slowly at the present time.

At the age of 14 years, while attempting a high jump over a fence, he caught his foot, which threw him to the alley pavement on his left side. He had severe pains over the left kidney for ten days, followed by voiding of bloody urine. He was given a transfusion of 400 c.c. of blood, without checking the hemorrhage. Thirty-six

hours later, he was given another transfusion of 240 c.c. of blood. A slight trace of blood showed in the urine for ten days after this. This fall also injured the left knee again, though slightly.

He has always been very active, although he takes cold easily, which is usually followed by a swollen joint somewhere; those mainly affected being the right ankle, left shoulder, and left elbow. There have been long periods, two or three years at a time, when he has had only slightly swollen joints.

Roentgen Findings.—Left shoulder joint: The shoulder is somewhat enlarged; no abnormality is shown in the films taken. Left elbow: There is a small area of de-

creased density in the external condyle, and a similar area in the olecranon process. Left wrist: The ulna is shortened; it does not articulate with the wrist. Left hand: Claw-like. There are no bone changes. Left knee: The intercondyloid notch is deepened and widened. There is an area of decreased density on the external part of the epiphysis. There is a widening of the space between the tubercles of the spine, and there are areas of rarefaction between the tubercles and beneath the spine. Right wrist: There is a slight widening of the lower end of the ulna. The wrist and hand are normal. This hand has spells of flexion of the fingers which can gradually be overcome. Right

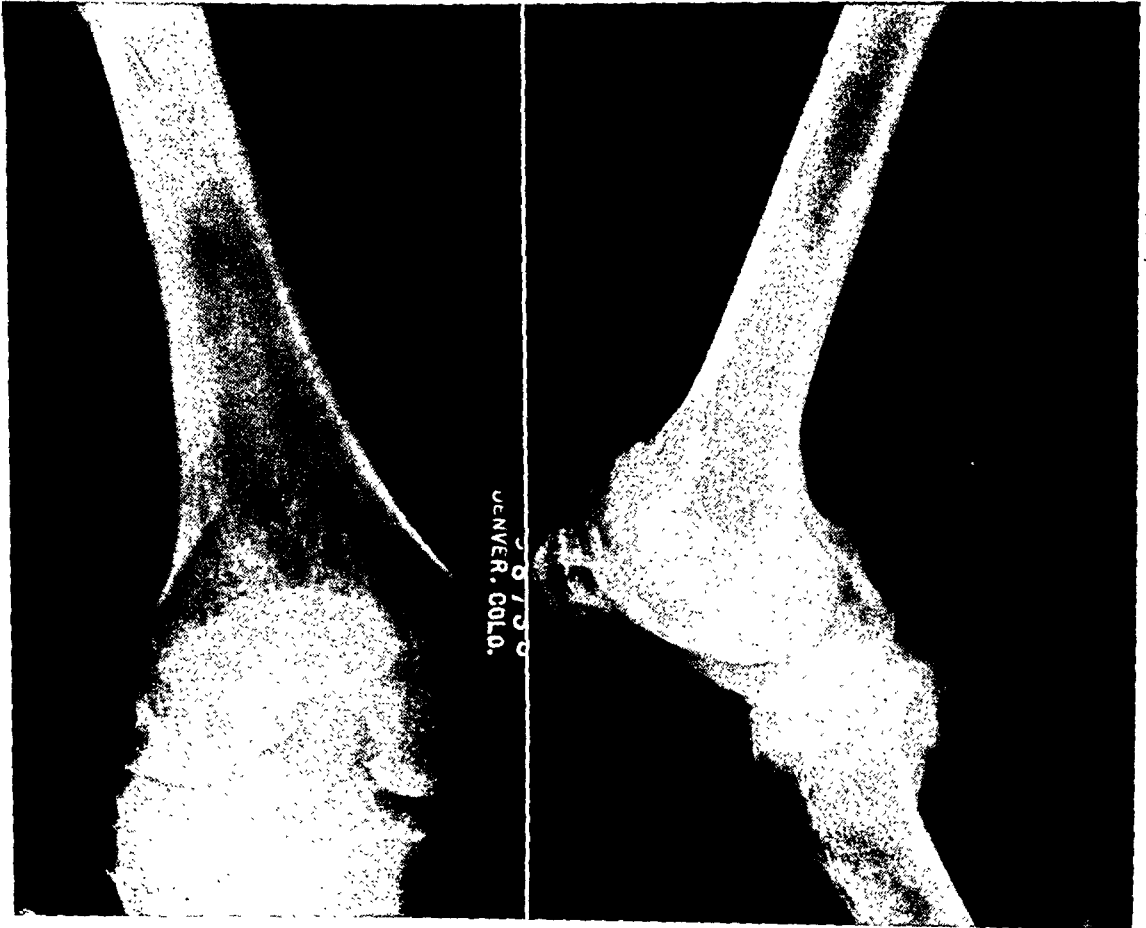


Fig. 6.

Fig. 7.

Figs. 6 and 7. Case 3. Anteroposterior and lateral views of the left knee. There is a widened and deepened intercondyloid notch, a punched-out area above the external condyle, flattening of both tubercles of the spine of the tibia, and irregularity of the articular surface of the internal tuberosity. There is rarefaction of both condyles of the femur, and a small exostosis on the anterior surface. There is rarefaction of both tuberosities and of the patella.

hand: . There are no bone changes. Right foot and ankle: Normal. Hip, back, and pelvis: Normal.

tween the tibia and astragalus, and also between the astragalus and os calcis. There is an increase in the density of the



Fig. 8. Case 3. Right ankle. A narrow joint space is present, indicating absorption of the cartilage. Note the following: (a) Punched-out area close to the internal malleolus; (b) absorption of cartilage between articulation of astragalus and os calcis, and (c) transverse ridges in bone structure of lower end of tibia.

Case 2. Family History.—Mother's brother died of hemophilia at two years of age. His mother's sisters had three sons, all of whom died of hemophilia.

Personal History.—Male, 56 years of age. From infancy he has had spells of bleeding, several of which were extremely severe. We examined him for a hemorrhage into his left hip recently. In May, 1938, the coagulation time was 40 minutes; bleeding time, one and one-half minutes; blood platelet count, 180,000.

Roentgen Findings.—Both hips: Negative. Right knee: The intercondyloid notch is deepened and widened, and there is irregularity of the spine. Left ankle: There is absorption of cartilage, and an irregularity of the articulation between the astragalus and os calcis. Right ankle: There is absorption of the cartilages be-

bones adjacent to their articulations. Right elbow: There is an enlargement of the head of the radius and of the olecranon process. There are punched-out areas in the olecranon. The lower end of the humerus, head of the radius, and the olecranon process of the ulna show rarefaction.

Case 3. Family History.—The mother (Mrs. J.) of Case 3 states that there were four children in her family—three brothers and herself. The only aunt was a maiden lady. There was no history of hemophilia in the preceding generations. Mrs. J. had three sons, two of whom were hemophiliacs.

1. One son died at the age of 15, due to a ruptured bladder from a kick while scuffling. He was operated upon, but died in a few days from hemorrhage. At the age of two years, he had swollen

joints, mainly involving the wrist and ankles; the fingers and toes were not involved. At the age of six, he bit his

normal in about five to six weeks. He has had trouble with the right ankle at least ten times, but apparently is well between

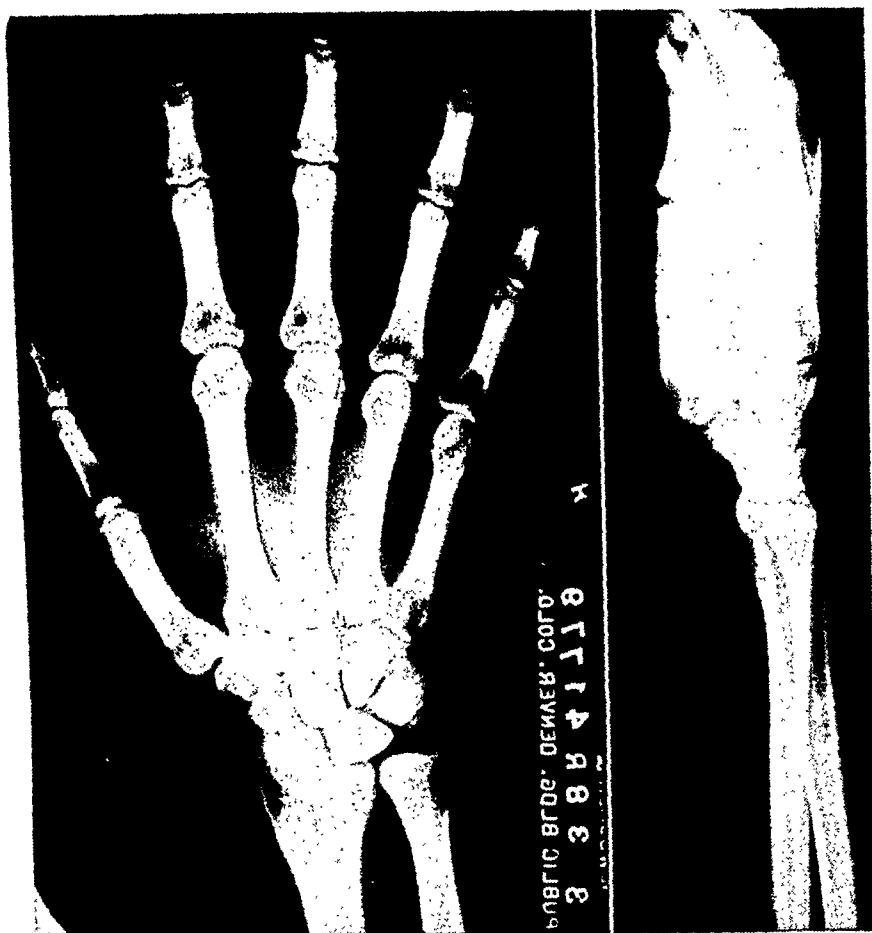


Fig. 9. Case 3. Right hand. Showing absorption of cartilage between the radius and scaphoid.

tongue and it was impossible to stop the bleeding for two weeks. He bled profusely when his baby teeth erupted.

2. Son, aged 30; living and well. His appendix has been removed, and he has had an operation on his nose. He has had no abnormal bleeding.

3. Son, aged 36. (This is Case 3.)

Personal History.—Married, no children. This patient stated he always bruised easily. He bled when his baby teeth were extracted and bled through the stitches when an accidental wound had been sewed up. At about the age of ten, he twisted his right ankle; it swelled and he had to walk on crutches; returned to

attacks. The left ankle also becomes swollen, but not as much as the right. The left knee was injured 15 years ago and still bothers him some; the right knee has been swollen and stiff, but does not bother him at the present time. Eight years ago he injured the left hip and was in bed for two weeks on account of hemorrhages into it: remained swollen for a year. At the age of 23, he was injured internally by a fall: in the hospital for a week, but the internal bleeding stopped without an operation. He bled for eight days following the removal of one tonsil by electrocoagulation, at the age of 28. His left leg was paralyzed for six months following a blow over

the left hip. At the present time, he says he has pain in the back, but it is not stiff. His shoulder pains him at times, and his neck becomes stiff. The wrists and fingers swell occasionally, but they appear to be normal now. The left leg is swollen and shorter, due to atrophy. He has been given blood infusions and amniotin at various times. His coagulation time has been 28 minutes and up.

Roentgen Findings.—Both hips: No changes. Left knee: There is a widened and deepened intercondyloid notch, a punched-out area above the external condyle, flattening of both tubercles of the spine of the tibia, and irregularity of the articular surface of the internal tuberosity. There is rarefaction of both condyles of the femur, and a small exostosis on the anterior surface. There is rarefaction of both tuberosities of the tibia and of the patella. Right knee: There is a slight irregularity and deepening of the intercondyloid notch. Both tubercles of the spine are sharpened. There is a punched-out area beneath one tubercle, and punched-out areas in the patella. Right ankle: A narrow joint space is present, indicating absorption of the cartilage. There is (1) a punched-out area close to the internal malleolus; (2) absorption of cartilage between the articulation of the astragalus and os calcis, and (3) transverse ridges in the bone structure of the lower end of the tibia. Left elbow: There is slight enlargement of the joint, irregularity and enlargement of the head of the radius, and irregularity of the external condyle of the humerus. Right shoulder: There is some absorption of cartilage, also punched-out areas in the head of the humerus. Right hand: There is absorption of the cartilage between the radius and scaphoid.

CONCLUSION

The fact that characteristic joint disease occurs in at least 80 per cent of hemophili-

acs is not generally recognized by the medical profession. There are really two stages: (1) Acute hemorrhage into the joint and (2) the chronic stage in which changes in the joint are produced by these hemorrhages.

Again I wish to emphasize the careful elimination of hemophilia as a causative agent in both acute and chronic disease of the joints, and the fact that characteristic joint changes occur in hemophiliacs. In the three cases reported in this paper, surgeons have repeatedly suggested or attempted operations, not realizing that the joint changes were due to hemophilia.

BIBLIOGRAPHY

- (1) BIRCH, C. L.: Hemophilia. *Jour. Am. Med. Assn.*, 99, 1566-1572, Nov. 5, 1932.
- (2) BRAILSFORD, JAMES F.: *The Radiology of Bones and Joints*, pp. 205 and 447, J. & A. Churchill, Ltd., London, 1934.
- (3) DAVIDSON, EDWARD C., and McQUARRIE, IRVINE: Hemophilia: A Study of the Blood, the Clinical Course, and the Heredity in Three Cases. *Bull. Johns Hopkins Hosp.*, 36, 344, 345, 1925.
- (4) DOUB, HOWARD P., and DAVIDSON, EDWARD C.: Roentgen-ray Examination of the Joints of Hemophiliacs. *RADIOLOGY*, 6, 217-227, March, 1926.
- (5) FIROR, WARFIELD M., and WOODHALL, BARNES: Hemophilic Pseudo-tumor: Diagnosis, Pathology, and Surgical Treatment of Hemophilic Lesions in the Smaller Bones and Joints. *Bull. Johns Hopkins Hosp.*, 59, 237-250, October, 1936.
- (6) HESS, A. F.: The Calcium Factor in Hemophilia: A Case with Calcium Deficiency (Calcipriva). *Bull. Johns Hopkins Hosp.*, 26, 375, 376, 1915.
- (7) KEY, J. A.: Hemophilic Arthritis (Bleeders' Joints). *Ann. Surg.*, 95, 198-225, February, 1932.
- (8) LÖHR: *Deutsche Zetschr. f. Chir.*, 228, 234-248, 1930.
- (9) OTTO, JOHN C.: An Account of an Hemorrhagic Disposition Existing in Certain Families. *Med. Repository*, 6, 2, 1803.
- (10) PATEK, ARTHUR J., JR., and STETSON, RICHARD P.: Hemophilia. 1.—The Abnormal Coagulation of the Blood and its Relation to the Blood Platelets. *Jour. Clin. Investigation*, 15, 531-542, September, 1936.
- (11) RYPINS, EDWIN L.: The Roentgen Ray as an Aid in the Diagnosis of Hemophilia. *Am. Jour. Roentgenol. and Rad. Ther.*, 31, 597-602, May, 1934.
- (12) SOLIS-COHEN, LEON, and LEVINE, SAMUEL: Bone and Joint Changes in Hemophilia. *Am. Jour. Roentgenol. and Rad. Ther.*, 31, 487-491, April, 1934.
- (13) THOMAS, HENRY BASCOM: Some Orthopedic Findings in 98 Cases of Hemophilia. *Jour. Bone and Joint Surg.*, 18, 140-147, January, 1936.
- (14) WITTS, L. J.: The Hereditary Hemorrhagic Diathesis. *Guy's Hosp. Rep.*, 82, 465-474, October, 1932.

THE MEASUREMENT OF TISSUE DOSAGE IN RADIATION THERAPY¹

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THE measurement of tissue dosage, and its expression in terms of a satisfactory unit, are questions continually before radiologists at the present time. It has long been conceded that it is desirable to know the quantity of radiation delivered to the tissues undergoing treatment. It is recognized that, since biological changes are very probably due to ionization produced in the irradiated cells, the dosage unit should be based on some form of ionization measurement. It would, of course, be highly desirable to measure the ionization actually produced in the tissues.

Since up to the present time this has not been feasible, it is necessary to use the ionization in a gas in some manner as the standard. Failla has suggested that the tissue dose unit should be based on the ionization produced in a certain mass of air at a given point in a given medium, under the conditions in which the radiation is to be utilized (1). The actual number of ions chosen as the unit could well be the number corresponding to the international roentgen, namely, 4.19×10^9 per cubic centimeter of air under standard conditions, which amounts to 324×10^{10} per gram of air. In this case a modification of the definition of the roentgen, such as is contemplated at this Congress, would make it possible to express air and tissue doses in terms of the same unit.

It is recognized that any unit proffered at the present point in the development of the problem may be imperfect. The great need at the moment is not the attainment of physical accuracy, so much as it is the securing of consistency among radiologists in specifying dosage. When

the physicists shall have worked out a satisfactory unit, data recorded under any reasonable scheme can be transferred to the new unit with sufficient accuracy for all clinical and biological purposes.

It will be desirable, however, not to speak of tissue doses measured in terms of this unit as being measured actually in roentgens. For convenience, and for want of a better term, they may for the present be referred to as "tissue roentgens." It will be wise to keep some such means of distinguishing them from true roentgens until the whole matter of dosage units is settled.²

In discussing tissue dosage in radiation therapy, it is usually desired to know the quantity of radiation delivered to each skin portal, and the total dose administered to the diseased region. In order to measure this dose in terms of tissue roentgens, it would be necessary to have an instrument which would measure accurately the number of ions per gram of air, produced at the point where the radiation is utilized. On the other hand, if it could be determined once for all how the tissue dose at any point is related to the roentgens per minute in air at the position of the skin portal, then the dosage for any particular treatment could readily be calculated.

Many attempts at actual measurement of tissue dosage have been made. It has been known for several years that, with certain precautions, small ionization chambers can be constructed which will measure x-rays correctly in air, within a certain range of wave lengths. It has frequently been assumed that any good "air

¹ Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13-17, 1937.

² The new definition of the roentgen, adopted by the Units Committee of the Fifth International Congress of Radiology, Chicago, 1937, still does not, in general, do away with the necessity for distinguishing between air dose and tissue dose.

this volume. By separating the plates another millimeter, the ionization in the next 0.635 c.c. can be determined. If this

units, the actual number of ions per cubic centimeter (or per gram of air) can thus be measured at any point within the phantom.

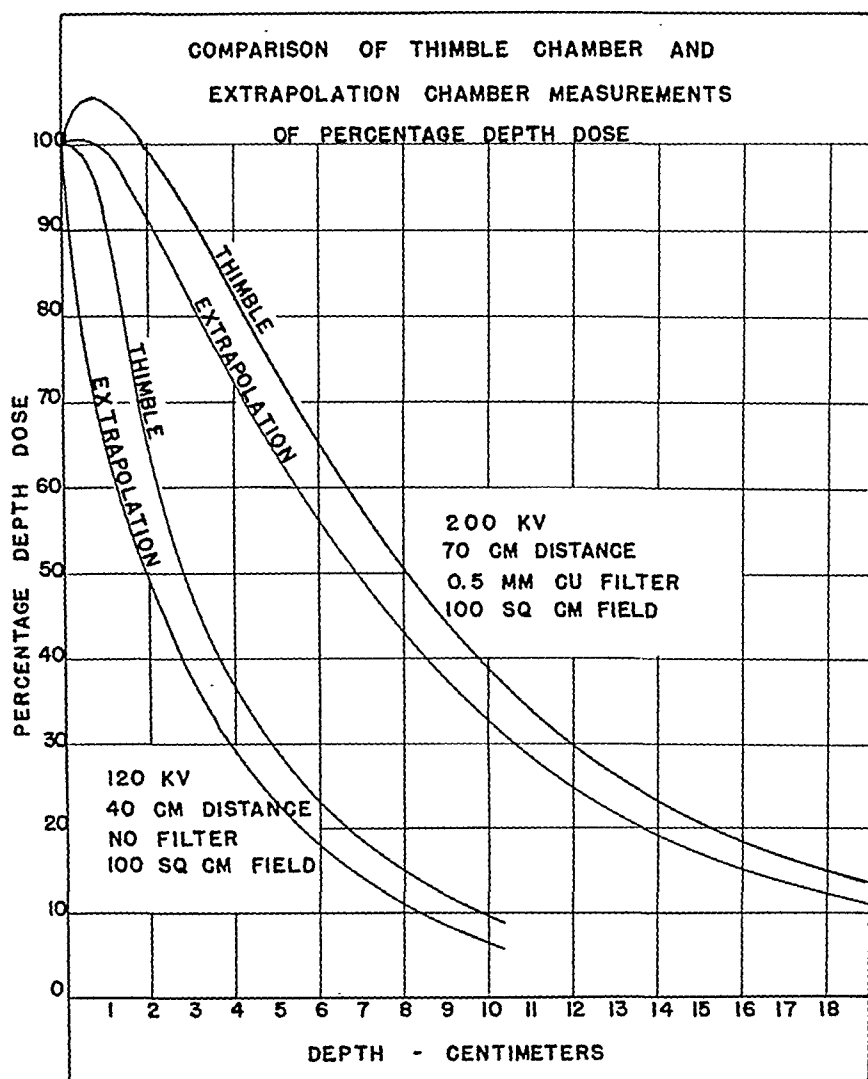


Fig. 2. Curves showing comparison of thimble chamber and extrapolation chamber measurements of percentage depth dose.

is the same as the first, the chamber is thus far independent of volume effect. That is, the number of ions formed *per cubic centimeter* of air is constant. This has been found to be the case, up to four- or five-millimeter separation, for the several qualities of x-rays studied up to the present time, both on the surface and in the interior of the phantom. If the measuring instrument is calibrated to read in electrostatic

The level to which this measurement refers can be determined within a fraction of a millimeter.

When the chamber was first built, it was not expected that the ionization per cubic centimeter would be independent of the ionized volume within the limits just mentioned. The original plan was to determine the ionization per cubic centimeter for gradually decreasing volumes, plot a

curve from these data, and extrapolate it to a vanishingly small volume, thus obtaining the ionization per cubic centimeter effectively at the surface of separation. It was from this plan that the chamber was given its name. This procedure seems to be unnecessary within the range of ordinary x-ray therapy, as just stated. No experiments have been made as yet with x-rays of greater half value layer than 2.5 mm. copper. In the work with gamma rays, extrapolation was necessary. This, however, is in part because of the relatively short distances between the ionization chamber and the radium. A change in the electrode separation altered the radium-chamber distance, as the apparatus was set up. Other factors may have been introduced by the geometry of the radium container (the four-gram radium element pack), so that at this time no conclusions can be drawn regarding what is to be expected from super-voltage x-rays. Nor is any information as yet available with regard to wave lengths longer than those used in superficial therapy.

Figure 2 shows a comparison of depth dose curves obtained with one particular thimble chamber and with the extrapolation chamber, with the same phantom material, for two widely different qualities of radiation. It is observed that in all cases this thimble chamber gives higher percentage depth doses than the extrapolation chamber, and that the percentage difference between the two is not constant.

For application to clinical problems, the material of the phantom is of great importance. Various substances have been used by different workers, mainly water, grains such as rice and wheat, and various waxes. Water, being a liquid and a conductor of electricity, offers experimental difficulties; the waxes have too high a hydrogen content to be satisfactory tissue substitutes; the grains, by their structure, make accurate measurements near the surface difficult. Certain organic substances available in sheet form have been subjected to various laboratory tests (2). The most satisfactory substance thus far found is a

commercial compressed cellulose product by the name of "pressdwood." This fulfils the requirements as to composition and density, is readily obtainable, and easy to handle. Accordingly it has been used as the phantom material in measurements made recently.

With the extrapolation chamber it is possible to determine the numerical relation between the number of ions per cubic centimeter (or per gram) in air and at any point within the scattering medium, irradiated according to any set of physical factors. It is, of course, also possible to calibrate a thimble chamber against the extrapolation chamber for any set of conditions, and then to use it to measure the tissue dose directly. *In such a case the thimble chamber can be correctly used only in the region in which it has been calibrated, both as regards quality of primary radiation and position within the phantom.* This procedure is, however, unnecessary. As was stated earlier in this paper, if the ratio between the tissue dose at any point and the air dose at the position of the skin portal is known, for a given set of treatment conditions, the tissue dose can be readily calculated when the output of the machine in air is known.

Since the x-ray machine is calibrated in terms of roentgens per minute *in air*, the back-scatter and depth dose factors may be given in such a form that the ions per cubic centimeter or per gram of air (or "tissue roentgens" per minute) can be immediately determined, or they may be given in the more familiar percentage form, which is of use mainly in expressing tissue doses in terms of erythema doses. Thus, for x-rays generated at 200 kv., with half value layer 1.0 mm. copper, for a filter of 0.5 mm. copper and a field of 100 sq. cm., the skin dose as determined by the extrapolation chamber is 1.36 times the air dose (or the back-scatter is 36 per cent). If the x-ray machine delivers 60 r per minute in air, it delivers 60×1.36 , or 82 tissue roentgens per minute in the skin at the same distance, in the center of a field of 100 sq. cm. At the same time, for a focal-

skin distance of 70 cm., the intensity at a depth of 10 cm. is 45 per cent of the *air intensity just specified*; 45 per cent of 60 is

27 tissue roentgens also. The advantage of calculating depth doses directly from air doses is, of course, that it eliminates one

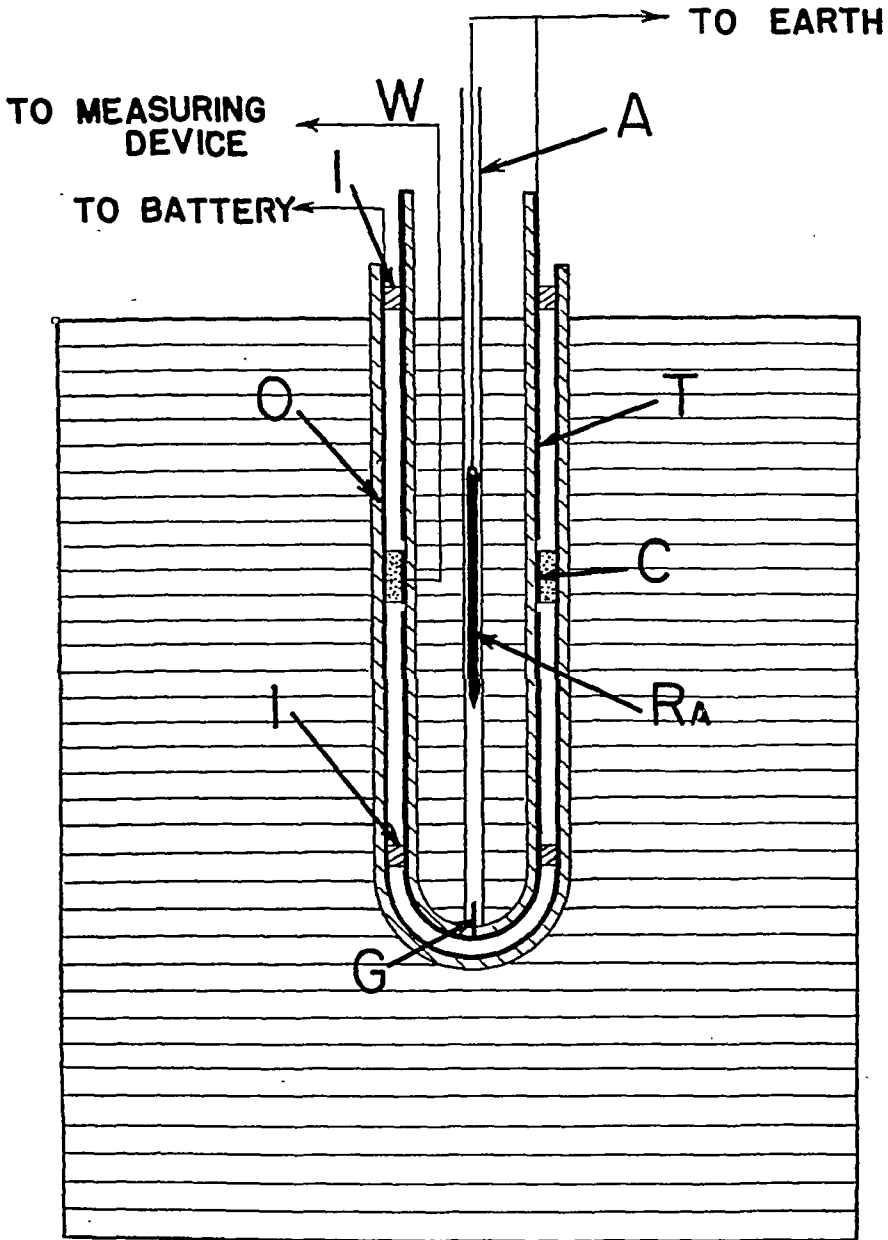


Fig. 3. Extrapolation chamber for the measurement of tissue doses in interstitial radium therapy.

27 tissue roentgens per minute. This method of calculating depth dose is not so familiar as that of saying that the depth dose under these circumstances is 33 per cent of the skin dose; 33 per cent of 82 is

step in the calculation. As long as depth doses were to be expressed only in terms of the percentage of the skin dose, and all tissue doses were specified in terms of erythema units, the second method just

given was necessary. At present, however, the tendency is toward expressing all doses in terms of the physical unit, which we are calling the tissue roentgen.

A very extensive series of measurements of surface and depth doses, for a wide range of qualities of radiation, is being made with the extrapolation chamber. Data for surface doses have been published (2). Those for depth doses will appear in future communications.

It must be remembered that in making dosage calculations, *all* the physical factors must be accounted for. It has been often the case that depth dose measurements made in a large phantom were applied to treatments in much smaller volumes. In order to obtain correct data for parts of the body such as the neck and limbs, it is essential to use a phantom much smaller than the ordinary one. Tissue doses for tangential irradiations cannot be properly obtained from isodose charts made with the beam of radiation entering the body at right-angles, nor can the exit dose (dose delivered to the skin by the beam emerging from the body opposite the port of entry) be obtained from such charts. The dose at any depth in a phantom has a considerable contribution from material lying still deeper, and this contribution is entirely, or almost, missing from the exit dose. Such a dose should be determined with the chamber actually on the exit surface of a phantom of the correct size. In irradiation about the head or limbs, the exit dose may assume considerable significance.

In this connection it must not be lost sight of that the effect produced by a given number of tissue roentgens in any tissue may be dependent on the quality of the radiation. This has been demonstrated to be very definitely the case with regard to the skin. For instance, for fields of 70 sq. cm. on the forearm, the threshold erythema reaction is produced by 525 r (measured in air) of radiation generated at 200 kv., having a half value layer of 1.0 mm. copper, and by 185 r of radiation generated at 85 kv., having a half value layer of 1.7 mm. aluminum. The tissue

roentgens (obtained by multiplying the air dose by the correct factor including back-scatter) are, for the first 1.33×525 , or 700, and for the second, 1.23×185 , or 230. That is, it requires three times as much of the harder radiation as of the softer (measured in tissue roentgens) to produce the threshold erythema. Now the quality of radiation is constantly changing on passing through tissue, so that the quality for the exit dose is definitely different from that for the dose at the port of entry. Adding the two values of tissue roentgens may lead to an erroneous idea of the skin effect to be expected. Since the exit dose has been frequently neglected in dosage calculations, it would appear that such an error, in present-day therapy, would not be serious. However, it serves as an example of what may arise in attempting too close a correlation between physical measurement and biological reaction.

It would be considered an advantage to be able to express all tissue doses, whether from external or interstitial sources, in terms of the same unit. Up to the present time, attempts to measure gamma rays in terms of roentgens have not been in good agreement, even for measurements in air, and extension to tissue dosage has resulted in further uncertainty.

By a modification of the extrapolation chamber the same system can be used to measure the ions per cubic centimeter at any point in a scattering medium around a radium source. The method is shown diagrammatically in Figure 3. The inner electrode is a thin celluloid test tube, T, containing the radium source. Its outer surface is coated with India ink, and a band, C, separated from the rest by scratches (as was the circular electrode in the large chamber, Figure 1). This band is the collecting electrode, connected to the measuring instrument by a fine wire, W. A second thin celluloid test tube, coated with ink on the inside, forms the outer (charged) electrode, O, the two tubes being mounted concentrically by means of insulating rings, I. Tube T is filled with water, and the whole immersed in a phan-

tom as shown. In the use of this chamber the effect of the inverse square enters even into very small changes of thickness of chamber, so that the ionization per cubic centimeter is not independent of volume for any range whatever. Hence the extrapolation scheme must be resorted to. This is done by using outer test tubes of different diameters. With such determinations, unless the ionization changes very rapidly with volume toward the limit, the method should give much more accurate data than any other heretofore employed.³

Discussion of tissue dosage in the present paper has been entirely on the basis of physical measurement. It must, however,

³ Since the presentation of this paper, considerable work has been done with small extrapolation chambers of this type. They have been found very satisfactory.

not be lost sight of that biological questions connected with the rate of administration—the fractionation and protraction of treatment—are also exceedingly important. In order to express clinically the total dose delivered over a period of time, some means must be found to express the net biological effect, allowing for tissue recovery, as well as the total physical dose. Such work is outside the scope of the present paper, but it is important to remember that, even when the physical questions are settled, the problem of tissue dosage measurement has been only partially solved.

REFERENCES

- (1) FAILLA, G.: The Measurement of Tissue Dose in Terms of the Same Unit for All Ionizing Radiations. *RADIOLOGY*, 29, 202-215, August, 1937.
- (2) QUIMBY, EDITH H., MARINELLI, L. D., and FARROW, J. H.: A Study of Back-scatter. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 799-815, May, 1938.

DOSAGE MEASUREMENTS BY SIMPLE COMPUTATIONS¹

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THE logical basis of tissue dosage, to the physicist, would be the actual increase of energy per unit volume of tissue brought about by irradiation. Direct methods of measuring dosage in these terms are not practicable, but the same object is served if an indirect means giving equivalent results can be set up. The conditions under which ionization measurements can be used for this purpose have been the subject of exhaustive investigations, notably by L. H. Gray. Briefly, Gray's conclusions may be summarized as follows:

The energy absorption per unit volume of a medium in which quantum radiation is being absorbed is proportional to the ionization per unit volume arising in a small air-filled cavity in the medium. The cavity must be situated at a depth in the medium not less than the maximum range of secondary electrons in the medium, and the linear dimensions of the cavity must be small compared with the range of the corpuscular radiation. Transcribing these conditions to conform with measurements in small ionization chambers it is seen that the wall thickness must be equal to the range of secondary electrons and that the proper linear dimensions vary from a few millimeters for gamma rays to one-tenth of a millimeter for x-rays generated at 200 kv. In principle then, it is possible to measure tissue doses by observations on the ionization in small chambers having tissue-equivalent walls. The limiting dimensions of the chambers are so small for x-rays at normal voltages that grave, perhaps unsurmountable, experimental difficulties are introduced. For this reason it has been proposed that all dosage measurements should be related to observations in

chambers having air-equivalent walls, and a revised definition of the international roentgen has been put forward on this basis. With air-equivalent walls the total ionization is strictly proportional to the volume of the chamber which can, therefore, be chosen of more practicable size.

Now under most ordinary conditions the tissue to be treated consists entirely of elements of low atomic number and the specific gravity is reasonably constant, so that the observed ionization per cubic centimeter in a minute tissue-wall chamber would be exactly proportional to the energy absorption in tissue, and further, this ionization per cubic centimeter would differ by a constant amount (about 4 per cent) from that in an air-wall chamber of any size. Hence the proposal to measure tissue dose in roentgens by means of air-wall chambers is acceptable as a general principle. Nevertheless circumstances do arise in which the energy absorption in tissue is not directly correlated with the ionization in an air-wall chamber, as, for example, in the neighborhood of skin or bone where elements giving an appreciable photo-electric effect are to be found. It is felt that any new phrasing of the definition of the roentgen should not preclude the possibility of allowing for these special effects in the statement of tissue dose by a too rigorous insistence on the merits of measurements with air-wall chambers.

The problem of tissue-dose measurement is by no means solved when we have laid down satisfactory experimental conditions. It is not feasible to insert ionization chambers in tissue to measure the dose in roentgens directly, and if it were the labor involved in exploring the complete radiation field for each individual case would be prohibitive. The question is not so much how to measure tissue dose, but how to avoid its measurement. I want,

¹ Presented before the Fifth International Congress of Radiology, at Chicago, Sept. 13-17, 1937.

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then, briefly to review the methods by which this can be accomplished in the light of the principles of measurement that I have outlined.

Although there is no sharp delineation in

over the range of variation that occurs in therapy. It assumes also that independent observations of the dosage rate in a measuring phantom under identical conditions of irradiation will agree. Figure 1 shows

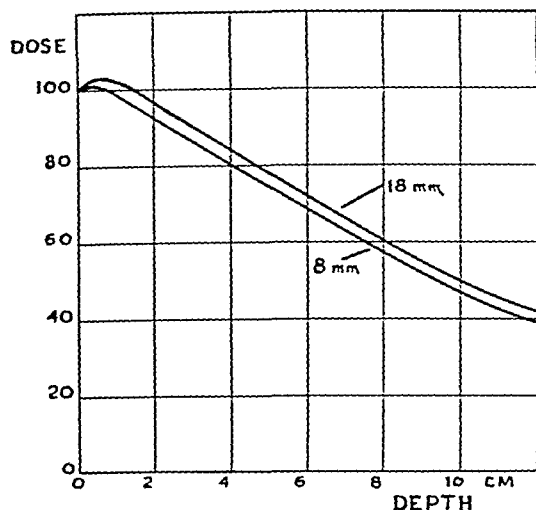


Fig. 1. Influence of chamber diameter on depth dose curves.

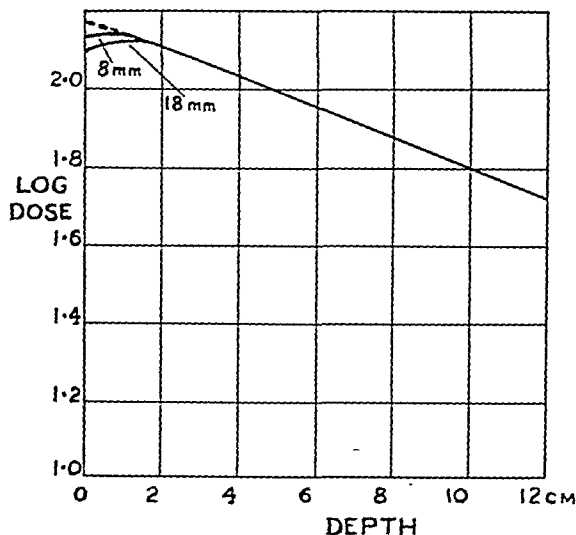


Fig. 2. Logarithmic depth dose curves set coincident at a depth of 5 cm.

the theory of ionization measurements between x-rays and gamma rays, there is in

actice a rather marked differentiation in the approach to dosage simplification for the two agents. For x-ray treatments the customary method is to use a series of isodose charts appropriate to one particular type of tube, together with tables of dosage rate for all the variations of tube voltage, current, filter, focus-skin distance, and field size to be employed. Many of these variables can be treated collectively if we postulate a change in the method of construction of isodose charts. Instead of writing 100 per cent as the surface dosage rate for each chart, let 100 per cent represent the dosage rate at a given point in air under standard conditions. The figures on isodose charts then give at once the tissue dose for the given incident quality of radiation for the focus-skin distance and field size in question. This assumes that the contribution of scattered radiation at any point depends only on quality, as measured by half value layer, and not on the spectral distribution. This appears to be valid

curves of depth dose for 200 kv. radiation incident on a large block of unit density wax, as recorded by two chambers of diameter 8 mm. and 18 mm., respectively. Both chambers had air-equivalent walls and their response to radiations of H.V.L. 0.3 mm. Cu to 3.0 mm. Cu ran exactly parallel. Yet the two curves are quite different in shape. The initial reading in each case was made with the chamber half immersed so that it is not surprising that there should be a marked difference in behavior over the range in which each chamber proceeds to the fully immersed position. It is more important that the increased depth dose persists at all depths. Suppose the curves are redrawn (Fig. 2) to make them coincide at an arbitrary depth, which here is 5 cm. The curves now coincide exactly except near the surface and one is tempted to derive a true depth dose curve by extrapolating the common part to zero depth. The method would acquire physical significance if the actual dosage rates at this depth were equal but this is not so. The value was 3 per cent more

in the large chamber at 5 cm. depth, and 3 per cent less at the surface. The difference at 5 cm. depth is simply explained by the reduced thickness of wax to be traversed in the case of the larger chamber.

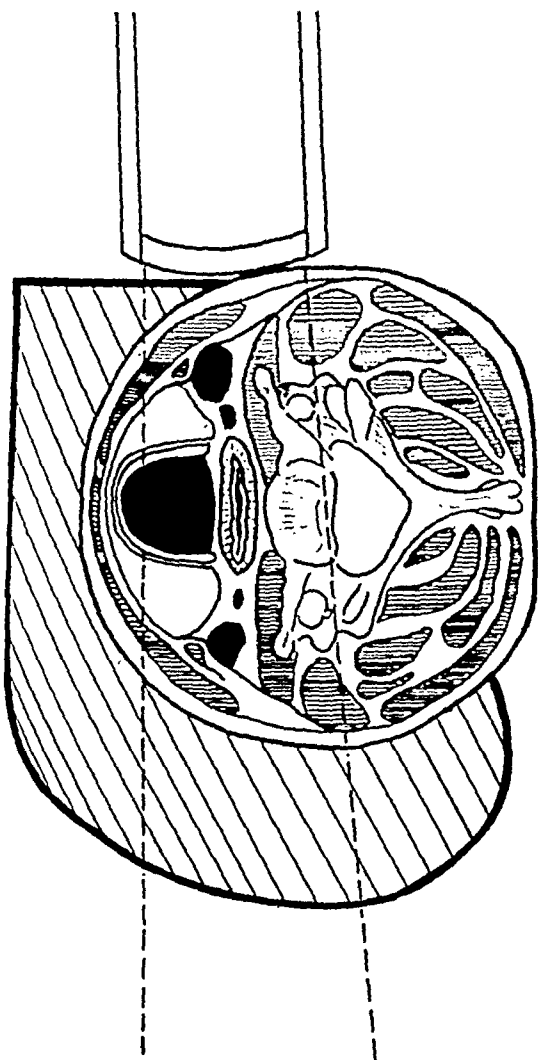


Fig. 3. Arrangement of wax block to bring a neck irradiation into approximate agreement with large phantom measurements.

We should expect an indefinitely small chamber to give readings some 3 per cent less again and this was verified by measurements in a chamber of 2 mm. diameter. At the same time, the apparent surface dosage rate rose by 3 per cent. The estimated shape of depth dose curve for an indefinitely small chamber approximated closely to the straight line in Figure 2, although the readings within 2 mm. of the

surface were unreliable. The dependence of dosage rate or chamber size is given in Table I for a few special cases. To make isodose charts of general utility it will be seen that all the observations must either

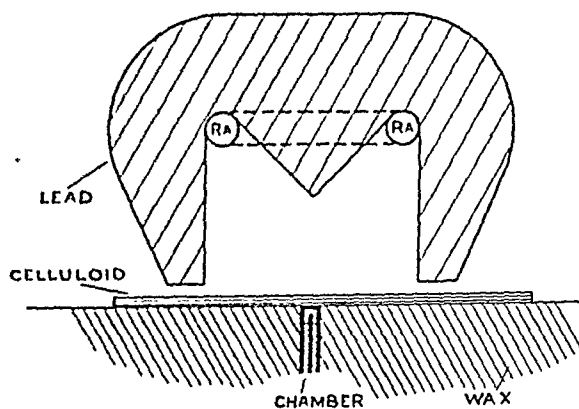


Fig. 4. Measurement of skin dose under conditions which generate copious secondary radiation.

be made with chambers much smaller than those commonly employed or corrected from measurements with two chambers. The use of small chambers is specially advisable when measuring the effects near the geometric edge of a beam the gradient of whose dosage rate is high.

The therapist equipped with a set of isodose charts derived from readings in a large phantom with beams at normal incidence desires to know to what extent they will be valid under the varying treatment conditions arising in practice. Better still, the physicist should define conditions under which the same charts may be used directly, so that the estimation of dosage can be kept in its simplest terms. The use of auxiliary scattering bodies to insure the restoration of equivalence between experi-

TABLE I.—DEPENDENCE OF DOSE ON CHAMBER DIAMETER

Chamber Diameter	Relative Dose	
	Near surface	5 cm. deep
V. small	143	100
8 mm.	138	103
18 mm.	135	106

ment and practice in irradiations at oblique incidence, or of limited masses of tissue, such as limbs and necks, is a familiar procedure. General conditions, which should be regarded as an integral part of a dosage

simple correction curve in such a way that the dosage for individual cases could be derived with a probable error not exceeding a small percentage. It may be claimed then that the tissue dose, which would be

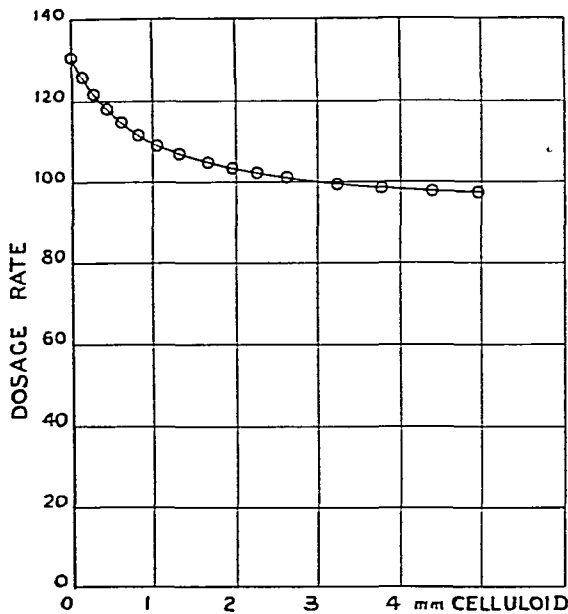


Fig. 5. Variation of skin dose with thickness of celluloid screen in Figure 4.

system, can be laid down. Thus for 200 kv. radiation full ionization is received at any point in the irradiated field when the scattering medium extends 8 cm. laterally beyond the geometrical limits of the beam and to 8 cm. beyond the point considered. For most purposes a thickness of 5 cm. is sufficient. The same thickness can be used over a wide range of radiations on account of the compensation between the penetration of the beam and the abundance of scatter. A typical application of the principle is shown in Figure 3.

Compensation for anomalous scattering regions within tissue is not feasible, but it appears, as, for example, in the measurements by Mrs. Quimby and her collaborators on cadavers, that the presence of bone or of small cavities does not seriously disturb the estimation of tissue doses from isodose charts. In some special cases, notably for lung cavities, a discrepancy arose which could be accommodated by a

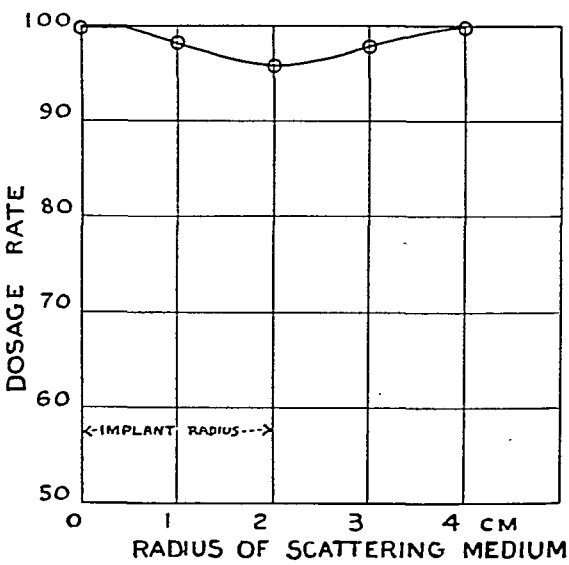


Fig. 6. Effect of scattering cylinders of various radii on the dose within a cylindrical radium implant. (Chamber wall = 1 mm. electron metal.)

recorded by a small air-walled chamber, can be written down within perhaps 5 per cent under all treatment conditions by simple computations from the basic and a knowledge of tube output.

It remains to be seen how far measurements would be affected by into account the presence of and cartilage associated with has been assumed so far that absorption in tissue will be directional to the measured incident in air-walled chambers. that the true absorption in the substances may be quite different on account of the photo-electric in the sulphur of skin, and the phosphorus of bone. It is estimated, for example, that in a minute chamber with walls may well be 50 per cent that in a tissue-wall chamber generated at 200 kv. Most of this additional effect ex

80μ from the actual sulphur-bearing layers. Blood capillaries are found within from 40μ to 140μ of such layers. Consequently it may be expected that the additional effects will play a part in the production of visible erythema reactions. It will follow that tissue doses, regarded as energy absorption, but determined by convention in terms of the ionization in air-walled chambers, may be seriously in error for soft radiation in just the cases which have been subject to the most careful clinical investigation. For the present, the best one can do is to regard an erythema dose as not yet having graduated to the status of a physical dose. Ultimately it may be possible to make a sufficiently close approximation to the photo-electric contribution, which could readily be applied to isodose charts of the type that I have described. In the meantime, it would be unfortunate if the anomalies of skin dose were allowed to discourage the statement of tumor doses in roentgens.

The analogous effects in bone and cartilage do not give rise to problems of physical interest. It is obvious that zones of high dose will occur within and in the immediate vicinity of these bodies. These zones constitute a potential danger in treatment and their appreciation can safely be left to the clinician.

In comparison with the x-ray problems the measurement of absolute tissue dose with radium is straightforward. The difficulties diminish rapidly as the wave length of the incident radiation diminishes. The permissible dimensions of the chamber increase inversely as λ^2 , and the disturbing photo-electric effect diminishes as λ^3 . The choice of material for chamber walls is also much less critical, and well-established corrections can be employed to convert readings in such convenient materials as elektron metal to the conventional equivalents for air walls. Against this one has to set the increased wall thickness of the chambers required to exclude secondary corpuscles generated at distant points from the chamber. It is well known that a thickness equivalent to some four milli-

meters of graphite is necessary and sufficient for this purpose. This condition modifies the conception of tissue doses under two circumstances, namely, near a skin surface or close to a radium needle used interstitially. Figure 4 illustrates a typical experiment on the magnitude of the first effect. An apparatus similar to a radium bomb was used to irradiate a block of wax in which was inserted a small cylindrical chamber with its axis at right-angles to the surface. The walls of the chamber consisted of elektron metal and the upper end was machined to a thickness equivalent to 0.7 mm. of tissue. Successive layers of celluloid were applied to the phantom surface and the ionization was noted at each stage. The ionization was reduced by approximately 25 per cent by the addition of 3 mm. of celluloid (Fig. 5). The conditions in this experiment were exceptionally favorable for the generation of extraneous secondary particles, but in some radium treatments the state of affairs is not dissimilar. For the sake of consistency, an adequate layer of celluloid, wax, or similar material should be placed on a skin surface during irradiation by external sources, so that the dose at a superficial point is derived entirely from the ionization produced by corpuscular radiation generated in the immediate vicinity.

The analogous effect round a radium needle in tissue is of little importance. It occurs in a region where the gamma-ray dose is already in excess of the general value and the extra ionization arising from secondary β particles produced in the needle wall merely shortens the total time for which a given needle can be safely left *in situ*.

Apart from these two effects the estimation of tissue dose for gamma radiation presents the fullest scope for simple calculation. Once the dosage rate in roentgens at one centimeter from a point source of one milligram of radium with standard filtration has been determined, the tissue dose at any point can be written down in general without further reference to ionization measurements. This basic value has

been the subject of exhaustive investigation by radiophysicists, and the more recent measurements have converged to a figure which can probably be written as 8.3 ± 0.2 roentgens per hour with 0.5 mm. Pt filtration.

Three types of radium treatment, which are amenable to different methods of dosage simplification, can be distinguished. These are the so-called bomb therapy, irradiation by radium moulds, and interstitial therapy. Dosage estimation in bomb therapy proceeds by means of isodose charts constructed in a manner identical with that for x-ray therapy. With radium moulds the determination of dose is particularly easy. One is normally concerned with conditions in the first few centimeters of tissue and within this range the net effect of absorption and scattering on the dose received at any point is so small that it can, in general, be neglected. The determination of dose thus becomes a purely mathematical exercise. Simple solutions depend upon the possibility of stating rules for the distribution of radium sources so that the dosage rate shall be approximately uniform and calculable over sheets parallel to the radium applicator. The complexity of any such system of rules is fixed primarily by the degree of accuracy to which the dose is made uniform over a given surface. Considering the inevitable error in the measurement of a treating distance of the order of one or two centimeters, a margin of error of ± 10 per cent is not unreasonable. This gives sufficient scope for generalizations which lead to a system of dosage calculation whereby the tissue dose at any relevant point can be written down at once when the area of the radium applicator, the treatment distance, and the effective radium content are known.

The extent to which the absorption of the primary radiation in tissue will influence a tissue dose calculated in this way depends very much on the geometrical arrangement of each particular case. It is probably for this reason that the reported values of the effective absorption are not consistent. It seems to be agreed that the

net absorption is not more than 4 per cent per centimeter; measurements that I have made suggested that a value of 2 per cent per centimeter would be a fair average. In view of the incidental errors of this type of therapy, it seems unnecessary to apply an absorption correction to depth doses up to 3 cm. deep.

Conditions in interstitial radium therapy are rather different. On paper, at least, it is possible to give rules for the distribution of radium sources in space in such a way that the dose will be approximately uniform throughout the volume contained, except within a few millimeters of each source, and can be calculated from the total volume and the effective radium content. These proposed arrangements have been set up in the laboratory and the radiation field explored by small ionization chambers. The dose in air has invariably been found to be consistent with the calculated value and the change in dose by immersion of the whole arrangement in a scattering medium of unit-density has been shown to be negligible. Actually, the dose reaches a minimum when the scattering medium just occupies the space contained by the needles (Fig. 6). With a phantom approximating to real conditions the tissue dose is never far from the air dose. At first sight, then, the calculation of dose in interstitial therapy would appear to be the simplest possible case. This would be true if radium needles could be inserted in predetermined positions, which is clearly impossible. The problem of dosage thus becomes the purely geometrical one of determining the actual configuration of sources in a radium implant. In some cases a study of two radiographs of the implant is sufficient for this purpose, but more generally it is essential to reconstruct the implant in space. To take an extreme case, the series of implants shown in plan in Figure 7 can be arranged to give identical radiographs in both anteroposterior and lateral films. The dose at a point A changes in this series by a factor of five. In real practice one can expect errors up to perhaps 50 per cent, if the dose is estimated from radiographs

alone. For this reason we have to regard the spatial reconstruction, which can be readily performed by optical means, as an

the only source of error of any importance being connected with special effects in skin. One essential feature stands out—that

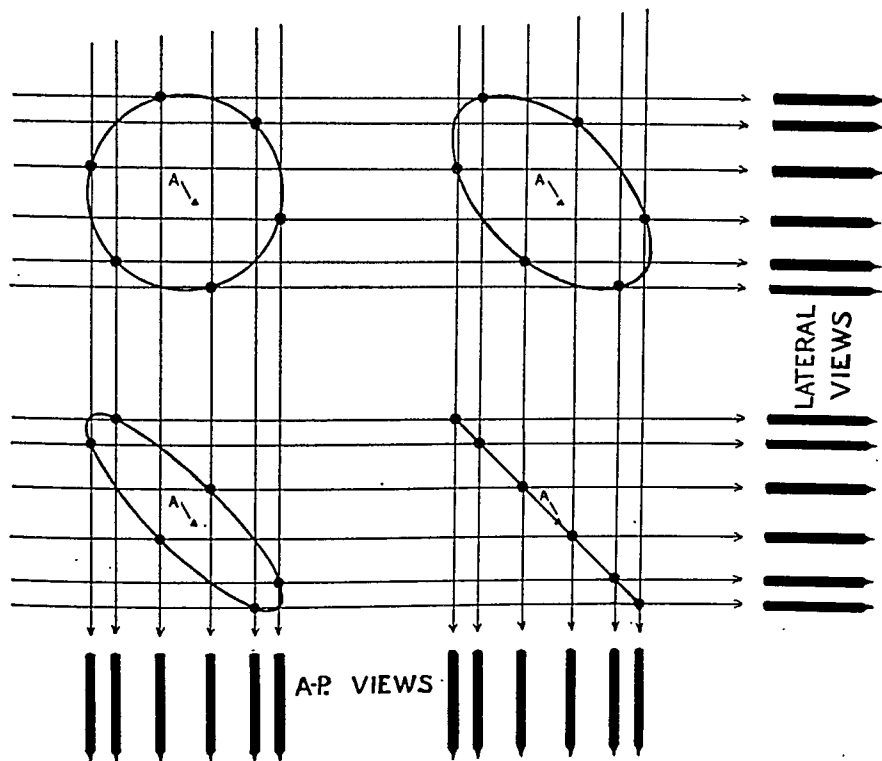


Fig. 7. Identity of the radiographs of four different implants, viewed by parallel beams of x-rays. With the normal divergent beams small differences arise which are inappreciable to the eye but can be analyzed geometrically or, more conveniently, by a special "implant reconstructor."

integral part, and in fact the principal part, of the mechanism of dosage estimation.

SUMMARY

To summarize this somewhat disconnected survey of the possibilities of reducing the determination of tissue doses to a system of elementary computations, it may be claimed that for radium treatments a simple system, sufficiently accurate for clinical requirements, can be established. For x-ray treatments, with which may be grouped radium bomb therapy, satisfactory results can be achieved by the compilation of isodose charts in a special way,

much closer collaboration between the physicist and the radiotherapist is called for. Simplicity in dosage cannot be achieved if the therapist uses his physical agents in any arbitrary manner, nor can the therapist tolerate restrictions on his technic so prescribed as to limit its utility to a few selected cases. Only by a careful consideration of the requirements of both specialists can a general scheme of treatment and dosage be built up, and not until such a system is available equally well to the smallest clinic as to the largest can we be said to have solved the problem of tissue dosage.

ALOE VERA IN THE TREATMENT OF RADIATION ULCERS OF MUCOUS MEMBRANES

By FREDERICK B. MANDEVILLE, M.D., Professor of Radiology, Medical College of Virginia, Richmond, Virginia

IN 1935, Collins and Collins (1) published a favorable report on the treatment of roentgen dermatitis with the fresh whole leaf of *Aloe vera*. Later that year Collins (2) added a report on the use of an ointment of *Aloe vera* (Alvigel) as a therapeutic agent for roentgen and radium burns. The following year Wright (3) gave a paper on the use of *Aloe vera* in the treatment of roentgen ulcers and telangiectasis. He concluded that (3):

"From the cases reported it would seem that x-ray ulceration, even of several years' duration, will respond to the use of *Aloe vera*. The permanence of the results can be determined only by watching cases thus treated over a period of time. Little can be expected in the treatment of telangiectasis as a result of irradiation beyond the smoothing and softening of the affected skin."

Probably the most recent and authoritative information, worth quoting at length to bring it to the attention of radiologists, comes from MacKee, who says (3):

"During the past two or three years excellent results have been obtained with the jelly obtained from the leaf of a plant called *Aloe vera*. The plant grows in Florida. The leaf is green in color and long and wide—somewhat like a sword. The shell of the leaf is thick and tough, but when fresh can be cut easily with a knife. On one side of the leaf the shell is flat; on the other side it is convex. There is a thick layer of jelly-like substance between the shells. The leaf should be kept in a cool, moist environment. It is customary to cut a piece of the leaf to the size and shape of the lesion. The convex shell layer is removed. The jelly is placed in contact with the floor of the ulcer and held in place with a bandage. Dressings are changed once or twice daily. The treatment seems to be inefficacious for roentgen or radium sequelæ—atrophy, telangiectasia, sclerosis, and keratosis. It appears most effective in the case of indolent roentgen and radium ulcers. Often the pain disappears within a day or two and healing takes place in a few weeks or a few months—more often the latter. The writer can vouch for the good results in a fairly

large percentage of indolent ulcers. Good results have been obtained also in ulcers that occur early in third-degree reactions.

"To obtain satisfactory results it seems necessary to use the fresh leaf. Preparations on the market which contain the *Aloe vera* jelly have been thus far unsatisfactory. It is thought that the good results are due to vitamin D."

Our own personal experience in man has been limited to five cases. All five have experienced definite relief from pain and discomfort, as mentioned by MacKee. One case of severe roentgen dermatitis of the face, treated two years ago with the fresh leaf, can be recorded as an excellent result. Three other cases of roentgen ulcers of the skin, in patients treated for carcinomas of the prostate, breast, and vagina, died incident to their disease, before a reasonably accurate or satisfactory evaluation of *Aloe vera* therapy could be made. Relief from pain was definite, sloughing appeared to clear more readily, and skin grafting was successful in the breast case.

As no cases of radiation ulcers of the mucous membranes treated with *Aloe vera* have been noted by us in the literature, our purpose is to report the fifth case which has remained well for two years following healing of osteo-radio-necrosis of the tongue, floor of mouth, and mandible.

Case 5. A 54-year-old white male had noticed a growth 1 cm. in diameter on the right side of his tongue and floor of his mouth anteriorly for three months. This was removed by a surgeon with electrocautery and the pathologic diagnosis by A. C. Broders, M.D., was squamous-cell epithelioma, Grade 3. There was slight enlargement of the anterior right cervical lymph nodes. He was then referred for radiologic treatment. Intra-oral radium therapy, heavily filtered, and external deep x-ray therapy was administered over a ten-day period. The case was complicated by ex-

tensive peri-odontal disease, which seemed to be a factor in the marked and severe radiation reaction of the tongue and mouth which began on the fourth day following the completion of therapy. The acute reaction began to subside within 14 days, but during the next three months a large ulcer of the right side of the tongue and floor of the mouth developed. All of the teeth were extracted, a few at a time, but osteo-radio-necrosis developed in the right mandible in spite of expert dental care and mouth hygiene. An alcohol injection of the third branch of the right fifth nerve was performed but the patient still suffered pain in the floor of the mouth and tongue. The ulcer was deep and measured 5×1.5 cm. and left the right mandible exposed. Films of the mandible showed rarefaction of the upper right margin about 5 centimeters in length and 0.5 centimeter in depth. Approximately three and one-half months following radiation therapy the jelly-like substance of fresh *Aloe vera* leaf was held by the patient within the mouth for from one and one-half to thirteen and one-half hours daily for a period of eight weeks, averaging seven hours daily. Relief from pain was prompt and definite and the ulcer slowly grew smaller. Saline mouth washes were used between and after this *Aloe vera* therapy. Five weeks later a single sequestrum of the upper right mandible was lifted off with forceps. In another five weeks the ulcer was completely healed. Removable dentures were fitted six months later. The mouth is dry and there is some furrowing of the tongue and limitation of its motion. The patient

has been followed for two years since complete healing was obtained and has been seen in large radiologic clinics elsewhere, with no evidence of ulceration.

* We believe that osteo-radio-necrosis should be prevented when possible, but as rather large numbers of such cases are being reported from the larger radiological centers where protection, filtration, and dosage are carefully considered, any means which will aid in its treatment should be described.

SUMMARY

1. Recent literature on *Aloe vera* therapy for radiation ulcers of the skin is briefly reviewed.
2. Radiation ulcers of the mucous membranes and adjacent tissues of body cavities may also be treated with the fresh leaf of *Aloe vera*.
3. A case of osteo-radio-necrosis of the mouth so treated and well two years following healing is briefly reported.

REFERENCES

- (1) COLLINS, C. E., and COLLINS, C.: Roentgen Dermatitis Treated with Fresh Whole Leaf of *Aloe vera*. Am. Jour. Roentgenol. and Rad. Ther., 33, 396, 397, March, 1935.
- (2) COLLINS, C. E.: Alvagel as Therapeutic Agent in Treatment of Roentgen and Radium Burns. Radiol. Rev. and Chicago Med. Rec., 57, 137, 138, June, 1935.
- (3) MACKEE, GEORGE M.: X-rays and Radium in the Treatment of Diseases of the Skin. Third Edition, pp. 319, 320. Lea & Febiger, Philadelphia, 1938.
- (4) MANDEVILLE, FREDERICK B.: Radiation Sequelæ. South. Med. and Surg., 100, 69-71, February, 1938.
- (5) WRIGHT, C. S.: *Aloe vera* in Treatment of Roentgen Ulcers and Telangiectasis. Jour. Am. Med. Assn., 106, 1363, 1364, April 18, 1936.
- (6) FINE, ARCHIE, and BROWN, SAMUEL: Cultivation and Clinical Application of *Aloe vera* Leaf. RADIOLOGY, 31, 735, 736, December, 1938.

THE DIAGNOSIS OF UNUSUAL CALCAREOUS SHADOWS FOUND ON X-RAY FILMS OF THE ABDOMEN¹

By CASSIE BELLE ROSE, M.D., *Boulder, Colorado*

IN the years from 1922 to 1936, inclusive, almost thirty thousand films of the abdomen were taken in the x-ray department of the Presbyterian Hospital of Chicago. Unusual calcareous shadows found in this series of films, with their problems in differential diagnosis, form the basis of this report.

Each of these patients was studied in close co-operation with the attending physician by means of the clinical history and physical findings, as well as appropriate laboratory work, including thorough x-ray examinations. Most of them were further observed either at operation or autopsy. Without such close co-operation in the study of these cases, the diagnosis would often have been impossible.

Radiologists know that in the upper abdomen the most common calcareous shadows found by x-ray are kidney stones, with gallstones a close second. In the lower abdomen and pelvis those most frequently found are ureteral and bladder stones, phleboliths, calcified glands, and occasionally calcified fibroids in the female or prostatic calculi in the male. Other types of calcareous shadows occur infrequently. One must always be on guard for the unusual form or location of common shadows. In addition, there may be peculiar, rare, or atypical calcareous shadows which require, for diagnosis, every help possible, and may even then be in doubt.

The first three cases are unusual forms of common shadows found in the lower abdomen, and are reported because of the extraordinary size of each lesion.

CASE REPORTS

Case 1. The first case is that of a large, sharply defined, uniformly dense shadow lying within the bony pelvis and simulating

the cystogram of a moderately large bladder. Knowing that this is a male patient, which rules out calcified fibroid, and that there had been no injection of opaque material before taking the film, the x-ray diagnosis of an extremely large bladder stone is made. On cystoscopic examination this stone was visible and so large that the cystoscope could not be introduced more than an inch into the bladder.

Case 2. The next film shows two large calcareous masses, 7×5 and 7×10 cm., lying within the bony pelvis. Three or four smaller ones are also present. At first glance these shadows suggest two enormous bladder stones and several small ones. However, since the patient is a woman and these shadows are not close together, their outline is somewhat irregular, and they are not solid in their density, an x-ray diagnosis of multiple areas of calcification in fibroids is suggested rather than multiple bladder stones.

The pelvic examination revealed a hard, nodular mass the size of a large grapefruit lying in the hollow of the sacrum. It extended from the right to the left of the pelvic wall and almost as high as the symphysis pubis. The mass was not tender and did not compress the rectum. Therefore, the clinical and x-ray diagnosis coincided.

Ureteral and bladder stones sometimes occur in the same patient and usually both produce characteristic symptoms.

Case 3. The film of the next patient, a man 64 years of age, shows a concentric ringed dense shadow in the bladder region measuring 3×4 cm. (Fig. 1-A). Another shadow, sausage-shaped and hooked at its lower end, overlies the left sacro-iliac joint. It measures 3×8.5 cm. Its shape and position, in spite of its enormous size, suggest a ureteral stone.

On cystoscopic examination, only the

¹ Presented before the Fifth International Congress of Radiology, Chicago, Sept. 13-17, 1937.

bladder stone was visible: the other shadow could not be made out. A ureteral catheter could be passed only an inch into

multiple small ring shadows arranged like a string of beads and following a rather tortuous course transversely across the mid-



Fig. 1-A.

Fig. 1-A. Case 3. Film shows bladder stone and large low-lying ureteral stone. Both removed at operation. Patient's age, 64 years.

Fig. 1-B. The large ureteral stone recurred after ten years, and has persisted to date. Patient now is 78 years old.



Fig. 1-B.

this ureter, and pyelogram solution could be injected no farther. (This case was studied in 1923, before the advent of intravenous pyelography.)

The patient's symptoms pointed to a bladder stone—there was no indication of a ureteral stone. The bladder stone was removed through a suprapubic incision, and the other large stone seen by x-ray was removed through a longitudinal incision in the left ureter.

Ten years later this patient returned. To our surprise a similar stone, again symptomless, had recurred in the same ureter (Fig. 1-B). This stone has persisted to date. The patient, who is now 78 years of age, says that he is perfectly well and he certainly looks the picture of health.

In contrast to the foregoing cases, the next film presents small multiple shadows of a type rarely seen.

Case 4. This patient's film shows mul-

part of the bony pelvis. Never having seen this type of calcification, we made no x-ray diagnosis at that time. Soon afterward another patient was x-rayed to show an injection of lipiodol into the ejaculatory duct. Since this film resembled that of the previous case, we were able to make a diagnosis of the first case as calcification along the course of the ejaculatory duct and seminal vesicles.²

The shadows on the next film, while not strictly within the abdomen, are so striking as to warrant inclusion in this paper.

Case 5. The film shows many streaks and spots of dense material extending from the midpart of each ilium downward and outward to the upper part of the thigh. Once recognized, they are unmistakable. They are due to multiple hypodermic in-

² This case is reported in full by Norris J. Heckel, in *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 377, 378, March, 1938.

jections of opaque material into the buttocks. The shape of the shadow is determined by the technic of injection—a

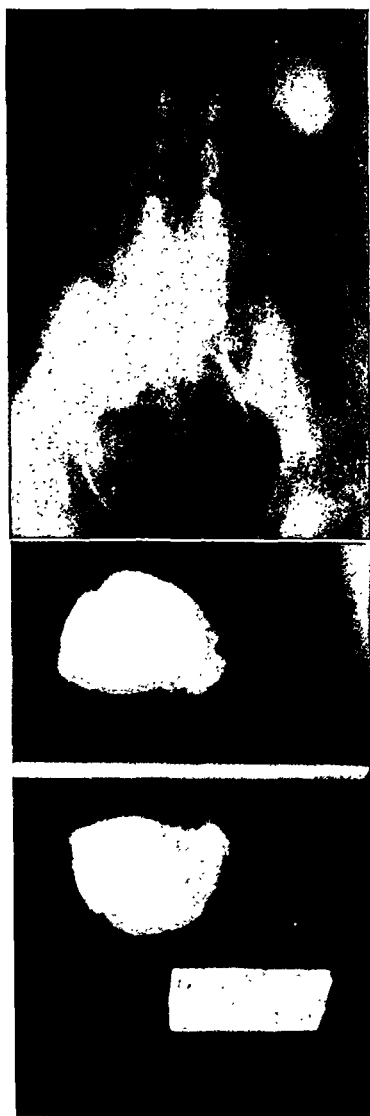


Fig. 2-A (above). Case 6. Oval densely calcified shadow, 5×7 cm., in left kidney region.

Fig. 2-B (below). Film of specimen which, after postmortem study, was diagnosed as an "extra-peritoneal peri-renal osteoma."

round spot if the needle is held still and a streak if the needle is being withdrawn during the injection. In the present drive against syphilis in this country, it is quite likely that many such cases will come to light in the future.

All radiologists have seen small oval and

large deer-horn kidney stones but a large oval shadow such as is shown in the next case is rare in the kidney area.

Case 6. On this film a very large, oval, densely calcified shadow is visible in the left kidney region on the anteroposterior view (Fig. 2-A). On lateral view it is over the second lumbar vertebra. Its position is, therefore, characteristic of kidney stone. It is of unusual size, measuring 5×7 cm., and in its upper portion there is a somewhat less dense area. The retrograde pyelogram shows a small normal kidney pelvis near the lower margin of this density and the rest of the pyelogram is not visible. The same is true with the intravenous pyelogram. The fluoroscopic examination shows this mass to be outside of the stomach and colon. The x-ray diagnosis was a rare type of kidney stone. The patient's death resulted from a ruptured diverticulum and peritonitis.

The postmortem examination revealed "a regular, oval, very firm mass posterior to the left kidney and loosely attached to the capsule of the kidney by threads of fibrous tissue." It suggested a dermoid to the pathologist. Microscopic studies showed "this mass to be only bone. The Haversian canals had multiple directions with no symmetry of arrangement of all." It was then diagnosed as an extra-peritoneal, perirenal osteoma.³ A film of the postmortem specimen is here shown (Fig. 2-B).

Shadows which at first suggest one type of lesion may, on further study, prove to be of an entirely different type.

Case 7. The postero-anterior film of this patient shows in the right upper quadrant a well-defined, closely packed, globular group of a hundred or more small stones which surely suggest gallstones (Fig. 3-A). However, on the anteroposterior view (Fig. 3-B) the stones string out for the length of three vertebrae, and three small groups of stones project laterally from the upper end of the large mass. On the lateral view the stones are grouped rather

³ This case is reported in full by Dr. H. L. Kretschmer in *Surg., Gynec. and Obst.*, 67, 108-113, July, 1938.

closely and overlie the second and third lumbar vertebræ as do kidney stones, instead of anterior to the spine in the gall-

over the ilium suggested a dermoid containing bone. We were not prepared for the findings at operation.

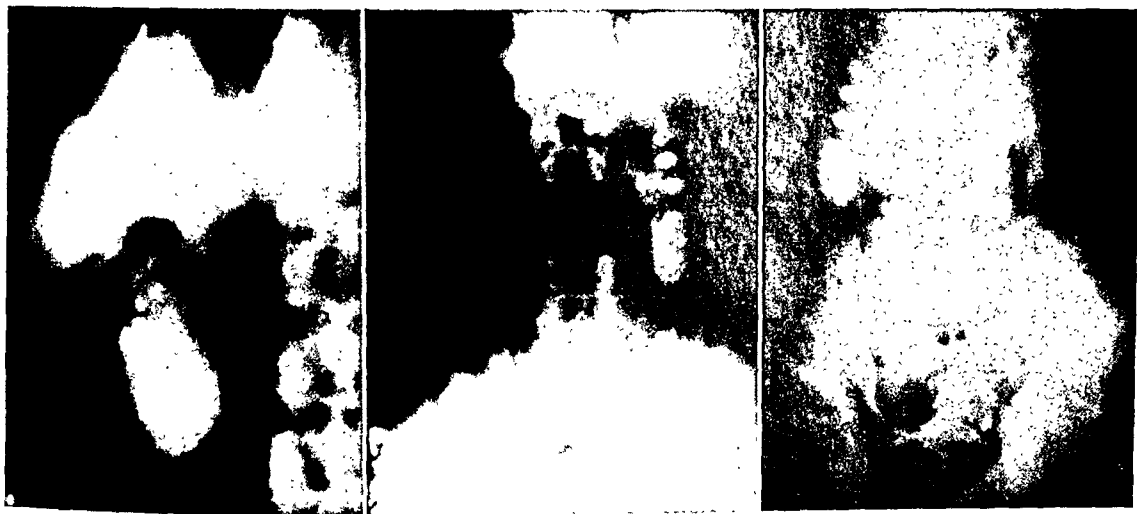


Fig. 3-A.

Fig. 3-B.

Fig. 3-C.

Fig. 3-A. Case 7. Postero-anterior film shows a hundred or more small closely packed stones suggesting gallstones.

Fig. 3-B. The antero-posterior view shows these stones strung out for the length of three vertebræ, with three small groups projecting laterally from the upper end of the larger mass.

Fig. 3-C. Film shows that the pyelogram increases the density in the area of the stones and spreads them apart slightly. Therefore, these shadows are in reality due to kidney stones.

bladder position. A pyelogram (Fig. 3-C) increases the density in the area of the stones and spreads them slightly apart. Furthermore, a cholecystogram shows a normal gall-bladder filling. A colon fluoroscopy shows the densities to be outside of the bowel. Hence a group of a hundred or more small stones which, at first glance seemed typical of gallstones, proved on further x-ray study to be kidney stones of most extraordinary number and grouping.

Occasionally kidney stones lie in a most unusual position.

Case 8. On this patient's film several irregular bonelike densities resembling phalanges overlies the left ilium. The left kidney outline is visible in its normal position and contains a little calcareous debris. The ureteral catheter passes mesial to the shadows over the left ilium. The ureter and one major calyx are fairly well visualized by the pyelographic solution. The other calices are not visible.

The kidney findings seemed to indicate tuberculous calcification, and the shadows

This patient came to the hospital because of a red tender area, which seemed to be an abscess, pointing in the region of the left groin. This abscess, when incised, opened into a large fibrous-walled cavity which extended to the kidney. From the bottom of this cavity several stones were obtained. These accounted for the shadows over the left ilium.

The course of events in this patient was then clear. An abscessed kidney had perforated and gravitated downward carrying with it multiple kidney stones. The kidney itself remained in its normal position and contained a small amount of sand.

Calcification in the spleen is comparatively rare.

Case 9. Occasionally, as with this patient, there is found in the spleen area a group of tiny, round, sharply circumscribed, uniformly dense shadows, often from fifty to a hundred or more. Such shadows arise from two causes: first, from multiple phleboliths in the spleen substance (which are of no particular clinical

significance) and, second, from small calcified tuberculous nodules in the spleen capsule which are comparatively rare. It is



Fig. 4. Case 12. Film shows the slightly mottled and the ring type of shadows due to multiple calcified echinococcus cysts in the liver.

noteworthy that tuberculous nodules which are not calcified show as areas of slightly lessened density on films of the spleen taken after its removal from the body.

Occasionally, one finds a ring shadow suggesting a gallstone except that it is on the left side. Such shadows may be explained as incomplete or partial calcification of the splenic artery. Marked calcification is shown on the films of the next two cases.

Case 10. This patient's film shows a tortuous double line of density in the left upper abdomen a little above the kidney and somewhat mesial to the spleen. It has the appearance of a calcified artery, which, from its position, is probably the splenic artery.

Shortly after this film was taken, the patient, a man 85 years of age, died from myocardial hypertrophy and degeneration due to coronary disease. The postmortem showed marked generalized arteriosclerosis, including the splenic artery. Even the arterioles of the spleen were considerably thickened.

Case 11. A few months later, the films of another male patient, 60 years of age,

showed an even more marked calcification of the splenic artery with associated gallstones. In this film the position and tortuosity of the splenic artery are clearly visible.

Tumors of many types may contain deposits of calcium either within or about the periphery of a degenerated or cystic area. Several examples follow.

Calcification of echinococcus cysts is sometimes shown on x-ray films. If present, this calcification is circular in outline. Sometimes there is a mottled or even a nearly solid density within the ring. There may be one or many such shadows. They occur in the liver and, it is said, sometimes in the spleen. If the cysts are not calcified, the x-ray film may reveal only an enlarged liver, which offers no differential criteria between echinococcus cysts and other types of liver enlargement. It is helpful to note the patient's nationality, usually Greek or Italian, although he may have lived many years away from his native land.

Case 12. The case here presented shows many characteristic shadows on the x-ray film (Fig. 4) which are sufficient for diagnosis of an echinococcus cyst and to differentiate from gallstone colic, which the symptoms so closely resemble. At operation 1,200 c.c. of pus was aspirated by means of a trocar. Then the liver was incised and there escaped from the right lobe a huge number of cysts varying in size from pinheads up to three inches in diameter. Several of these showed granular deposits on their outer surface, undoubtedly accounting for the shadows shown on the x-ray film.

Calcification is a frequent response in the healing of tuberculous lesions, such as a tuberculous kidney, mesenteric gland, or a psoas abscess. Such calcification is shown by x-ray examination as a mottled or "mulberry" type of shadow. A ring type of calcification is uncommon.

Case 13. In one patient, however, the x-ray film shows oval ring shadows lying close to the spine from the second to the fifth lumbar vertebrae; three on the left

side and one on the right (Fig. 5-A). The largest is the size of a hen's egg; the smallest about half that size. In addition, the

the ring shadows along the spine are due to calcification in multiple psoas abscesses or in tuberculous glands.



Fig. 5-A.

Fig. 5-A. Case 13. Film shows four oval ring shadows, three to the left and one to the right of lumbar spine, the largest is the size of a hen's egg. Third and fourth lumbar vertebrae are narrowed and irregular, with narrow interspace. Diagnosis is tuberculous spine with calcified multiple psoas abscesses.



Fig. 5-B.

Fig. 5-B. Lateral view of the same tuberculous spine. The calcified ring shadows are hidden by the vertebrae.

third and fourth lumbar vertebrae are narrowed and irregular along their intervertebral margins. The interspace is distinctly narrowed. Some calcification, with bridging, is present (Fig. 5-B) along the anterior and lateral margins of these vertebrae. The abdomen is otherwise normal. Intravenous pyelograms are normal except that the ureters are pushed out slightly in the region of these oval shadows. A chest film shows definite evidence of old, bilateral, partly calcified, upper lobe tuberculosis.

Nine years previously the patient had had a left mid-thigh amputation for tuberculosis of the knee joint and upper end of the tibia. With this history and the above x-ray evidence it seems certain that

Most uterine fibroids lie in the lower abdomen, and if calcified, their shadows are shown within the bony pelvis on x-ray films. However, calcification in very large fibroids may be shown by x-ray examination in any part of the abdomen, even under the costal arch. Therefore, such shadows may at times be confused with other types of calcification within the abdomen. It is most helpful in differentiation to note whether or not a soft-tissue tumor extends from within the bony pelvis upward high enough to contain the shadow in question. Very large fibroids simulate a pregnant uterus near term, except that fetal parts are not visible.

Other large abdominal tumors, such as

The pathologist felt that this tumor represented a multiple pregnancy in which one child, born at term, was host to cell inclusions which later developed fetal characteristics, thus producing this unnatural and perverted multiple pregnancy in a male child.

CONCLUSION

As consulting radiologists, let us remember that unusual cases, such as have been

presented, can be differentiated from more common lesions and correctly diagnosed only by a most careful consideration of all the evidence obtainable, not only from x-ray examination, but also from the clinical history, and physical findings. Therefore, it is imperative for us to work in close cooperation with the clinician, the surgeon, and the pathologist.

717 9th St.

CASE REPORT

RADIOGRAPHY OF THE PAROTID DUCT

By LESTER W. PAUL, M.D., Associate Professor of Radiology, University of Wisconsin Medical School, Madison, Wisconsin

Roentgen visualization of the parotid gland and its duct, free from overlying bony shadows,

An ordinary intra-oral occlusal type of film is used and positioned as shown in Figure 2, with the occlusal plane of the upper jaw parallel to the floor. The central ray is directed downward at an angle of approximately 60 degrees and forward about 20 degrees. The point of center on the cheek is slightly posterior, and above a point corresponding to the middle

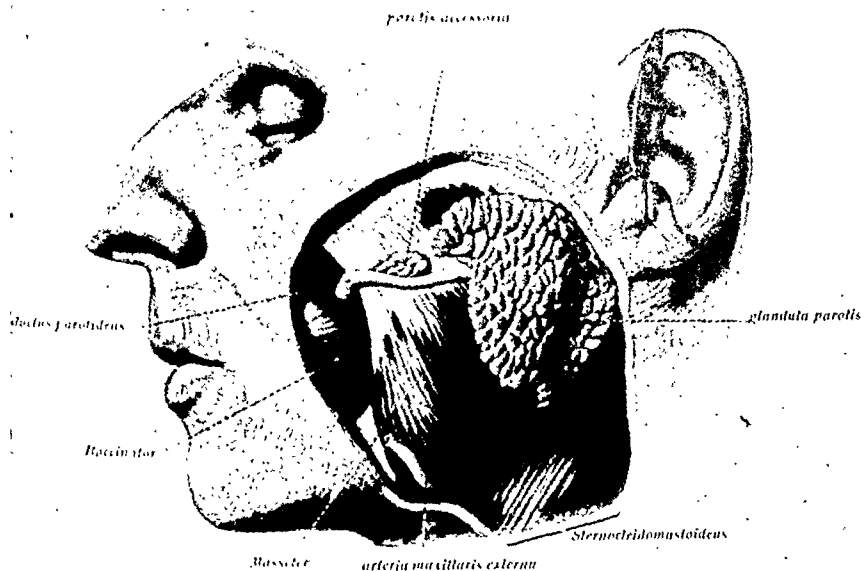


Fig. 1.

is, ordinarily, a difficult technical procedure. Since the majority of such examinations are done for the detection of stones, the presence of overlying bony shadows is a distinct handicap and conducive to diagnostic errors. If the jaws, especially the upper, are edentulous, less trouble is encountered, since it usually is the shadow of the upper teeth which interferes in lateral or oblique views. The majority of calculi are found in the ducts of the salivary glands rather than in the substance of the glands themselves. The method to be described allows clear visualization of Stensen's duct without any confusing bony or tooth shadows.

The gross anatomic features of the parotid gland and its duct are shown in Figure 1, taken from Sobotta and McMurrich's Atlas. On the surface, the course of the duct corresponds to the middle third of a line drawn from the lower edge of the external auditory meatus to a point halfway between the base of the nose and the vermillion edge of the upper lip.

third of the duct. The technical factors are those which would be satisfactory for the



Fig. 2.

upper bicuspid teeth. In positioning the film within the mouth it is necessary to bend it so that the outer surface is convex. The central

shadow, even though large, was missed in radiographic examination at another clinic and a diagnosis of tumor was made.



Fig. 3.



Fig. 4.

ray is then perpendicular to the film at the height of the convexity and since this corresponds to the area of the duct no significant distortion is produced. It is necessary to insert the film firmly against the anterior pillar of the tonsil and if gagging is troublesome, cocainization of the pharynx is recommended, although this will seldom be needed. The resulting radiographs are illustrated in Figures 3 and 4. Figure 3 is a radiograph made after the injection of lipiodol into the duct. Figure 4 shows a calculus impacted in the mid-portion of the duct. This stone

For visualization of the region of the gland proper, the view ordinarily used to show the ramus and coronoid process of the mandible is recommended. Because of the close relationship of the gland to the ramus it is impossible to visualize it entirely without the shadow of the ramus overlying a portion of it. With proper exposure factors and stereoscopic films, a sufficiently clear view will be obtained. This view is recommended, particularly when a study of the gland is to be made after lipiodol injection.

WHO SHALL PRACTISE MEDICINE?

Not the least important problem confronting the profession of radiology to-day is the question of the status and domain of the lay technician in radiological practice. It is a question which arises again and again, in one phase or another, as the Inter-Society Committee approaches professional and socio-economic situations in various sections of the country. It is a question which urgently demands solution.

A recent article by Albert A. Rayle, M.D., a portion of which is reprinted herewith by permission of the *Journal of the Medical Association of Georgia*, states the problem in clear fashion. In connection with Dr. Rayle's straight-forward comments, it is interesting to compare an article in a similar vein written more than ten years ago by the present Chairman of the Inter-Society Committee for Radiology, Arthur C. Christie, M.D.

Lest some misunderstanding occur, it may be well to define the term "lay technician" before quoting from the two papers mentioned above. Certainly neither the Inter-Society Committee, nor any individual radiologist, has anything less than the highest esteem and appreciation for the invaluable services of the technician whom he employs and upon whose conscientious loyalty and skill he depends for assistance in the practice of his profession. The function of these individuals fills an indispensable ancillary rôle in the practice of radiology.

But, when the lay technician attempts the practice of radiology upon his own part, without the supervision of a licensed physician-radiologist, he or she becomes a quack, proposing to render a service for which the individual is unqualified, untrained, and incompetent. He becomes a "limited practitioner" and like other cultists, he professes to possess special ability in a particular field without having gone to the trouble and expense of equipping himself with the essential medical background.

The question of the non-medical practitioner of radiology is one which threatens the very survival of a recognized and important specialty in medicine. The evil has been fostered by numerous modern developments in the practice of medicine, such as the industrial clinic where a lay technician examines and reports

on cases treated under workmen's compensation laws, and the attempts to divide the specialty into technical and professional phases under group hospitalization plans. If these situations are to be corrected, and if further unsound tendencies are to be forestalled, radiological practitioners themselves must point the way. If radiology is, as we contend, a clinical specialty demanding medical training instead of a technical laboratory procedure to be performed by laymen, then radiologists must demonstrate to their medical colleagues that such is the case.

It is somewhat paradoxical that the article published by Dr. Christie when he was editor of the *American Journal of Roentgenology and Radium Therapy*, in 1927, contains some answers to the questions posed by Dr. Rayle in his article written twelve years later. If this be irony, it simply goes to show that there remains much room for progress in the solution of a vexing problem.

From Dr. Rayle's paper, presented before a meeting of the Fulton County Medical Society, Atlanta, we quote as follows:

"There is an old feeling, still ingrained in the make-up of a physician, that he should devote his thoughts to the scientific phases of his work and let the economic phases take care of themselves. Perhaps this is the reason physicians are reputedly poor business men. But now the economic phases have thrust themselves on us and we have to talk about them, however distasteful it may be.

"We physicians have nothing to sell but our services. We have spent many years and many thousands of dollars to make those services worth something to the public—and we are entitled to sell them in fair market, without improper restrictions or unfair competition.

"Therefore we are all interested in what we call 'socialized medicine,' which, for our purposes, we will define as any system whereby either the professional or economic aspects of practice are controlled by laymen. The two go hand in hand, for economic control will lead to professional control. It is axiomatic that the man who pays the fiddler eventually will call the tune.

"For most of you, socialized medicine is something to talk about at medical meetings. For us in radiology it has arrived in one form or another. What I shall say will be primarily about radiology, but it applies also to other fields, and it is only a matter of time until it will concern every one of you.

"Realizing the dangers surrounding radiology from an economic standpoint, the four national societies have organized the Inter-Society Committee for Radiology, whose sole purpose is to deal with matters affecting the economics of radiologic practice. This Committee has asked and obtained the support of the Georgia Radiological Society, which at its last meeting appointed a committee to deal with the subject for which I speak tonight.

"The Georgia committee decided to limit its field to four topics. Of these, our first two problems are in process of adjustment and need not concern us in this discussion.

"Our third problem, the lay-radiologist, may be stated as a formula. (1) Radiology is the practice of medicine; (2) Medicine legally may be practised only by those physicians holding a license. (3) But laymen practise radiology. It does not come out even, or make sense. Why? Because certain members of the medical profession support and defend the lay-radiologist. Why? Because the lay-radiologist can and does offer inducements which medical men cannot ethically offer. You may ask why we do not hail the lay-radiologist to court. The reason is that if we do, he can and will employ a cheap doctor to go in partnership with him and sign his reports. As long as there are doctors who will do this, we can accomplish nothing.

"Suppose we set up a hypothetical situation equally as logical. I believe any one of you will agree that any bright young man with a reasonable amount of training could learn to take out tonsils, appendices, gall bladders, and uteri in an acceptable manner from a standpoint of surgical technic. Well then, why not train up a lot of laymen as surgical technicians? Obviously, you would say, 'Such a man would have no medical background. He might know how to take out an appendix but he would not know when.' Now that is just exactly the objection we offer to the lay-radiologist. He may be an excellent technician, he may have picked up a working knowledge of x-ray diagnosis, but he certainly cannot have acquired a medical background.

"But suppose we carry out the surgical

technician idea a bit farther. Say we have these trained surgical technicians. The internist might say, 'Well, this is great. I can make a diagnosis. I know when to operate. These fellows know how to operate. We will work together. I will send my patient to the surgical technician. He will operate for a few dollars a case. Why should I let the surgeon milk the cream from my patients?' Why, my friends, if any such system as this were seriously proposed, surgeons would be wringing their hands from Maine to California. And yet some surgeons support the same set-up in radiology."

From Dr. Christie's editorial, published under an identical title in the *American Journal of Roentgenology and Radium Therapy*, 18, 464, we quote the following:

"It is well known that there is a widespread and probably growing tendency to depend upon lay technicians, not only for the technical work which is their proper field, but for opinions on the roentgen findings, and even for diagnosis of the underlying pathological process. The medical profession itself is largely to blame for the development of this abuse just as it has been responsible by neglect of certain fields for the success of most of the medical cults. Roentgenologists themselves must bear at least a part of the blame for the assumption of medical functions by the technician. It is true that many roentgenologists take a very serious view of their responsibilities as medical consultants and follow the general practice of seeing every patient referred to them for roentgen-ray diagnosis, and their final opinion is based not only upon the roentgen-ray findings but upon a knowledge of the history of the case and all other information available.

"But on the other hand, there are many who base their entire report upon the roentgen findings alone, perhaps even upon films alone, never having seen the patient and having no knowledge whatever of the previous history, the course of the disease, nor the patient's present condition. There are, of course, situations in which the above course is not censurable, where the final results are to be evaluated by a well-trained internist who is capable of giving all information its due weight. Even in such instances, however, it is probable that better results are achieved by close co-operation and consultation between the internist and the roentgenologist than can be obtained by the roentgenologist's submitting a report based upon roentgenologic examination alone. It is a fact that in many offices and hospitals

the only person who really sees the patient who is referred for roentgen examination is the roentgen technician, and in many such places the technician's opinion is the only one sought.

"It is, therefore, not to be wondered at that the general physician who refers patients to roentgenologists for examination gradually comes to depend upon the technician for his findings rather than upon the doctor and that he finally adopts the practice of sending his patients to a commercial roentgen-ray laboratory or depends upon the report of a lay technician in a hospital. Only a little reflection, however, will show that such practice is not in line with general medical progress and that it carries actual and potential dangers of great importance. At the present time all over this country the roentgen ray is being used for diagnosis and treatment of disease not only by variously trained lay technicians but by the practitioners of almost all of the medical cults whether or not they are licensed to practise medicine. In recent times it is reported that

even 'beauty parlors' have used the roentgen ray extensively for the removal of superfluous hair.

"The cure for the 'technician evil' lies entirely within the medical profession. It will undoubtedly persist so long as there is a considerable number of physicians who do not realize that there is a wide gap between the films produced by the technician and their translation into terms of underlying pathology. The cure of the evil will be in sight when physicians realize that they are fostering another class of irregular, ignorant, unlicensed medical practitioners who are already rendering reports of roentgen-ray findings directly to patients and in some instances even using the roentgen ray as a therapeutic agent. In the meantime, the roentgenologist who takes a high view of his obligations would do well to review his own attitude and practice in the employment of technicians."

MAC F. CAHAL,
Executive Secretary

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please cooperate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—*Chairman*, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; *Secretary*, Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—*President*, E. N. Liljedahl, M.D., 1322 North Vermont Ave., Los Angeles; *Vice-president*, M. L. Pindell, M.D., 678 South Ferris Ave.; *Secretary*, Wilbur Bailey, M.D., 2007 Wilshire Blvd.; *Treasurer*, Henry Snure, M.D., 1414 South Hope Street. Meets every second Wednesday of each month at County Society Building.

Pacific Roentgen Club.—*Chairman*, Lyell C. Kinney, M.D., San Diego; *Secretary*, L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—*Secretary*, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—*President*, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president*, K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary*, E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer*, H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—*Chairman*, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer*, Max Clinman, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—*President*, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa; *Vice-president*, H. B. McEuen, M.D., 126 W.

Adams St., Jacksonville; *Secretary-Treasurer*, J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—*President*, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president*, L. P. Holmes, M.D., University Hospital, Augusta; *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—*President*, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president*, Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer*, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—*President*, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president*, Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer*, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The next meeting will be May 2, 3, 4, 1939, to be held in Rockford. The officers of the Section for the coming meeting are Harry B. Magee, M.D., of Peoria, *Chairman*, and Warren W. Furey, M.D., 6844 Oglesby Ave., Chicago, *Secretary*.

INDIANA

Indiana Roentgen Society.—*President*, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect*, Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president*, A. C. Holley, M.D., Attica; *Secretary-Treasurer*, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—*Chairman*, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary*, Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—*President*, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor; *Vice-president*, Clarence Hufford, M.D., 421 Michi-

gan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—*President*, E. R. Witwer, M.D., Harper Hospital, Detroit; *Vice-president*, D. W. Patterson, M.D., 622 Huron Street, Port Huron; *Secretary-Treasurer*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—*President*, Leo G. Rigler, M.D., University Hospital, Minneapolis; *Vice-president*, Harry M. Weber, M.D., Mayo Clinic, Rochester; *Secretary*, John P. Medelman, M.D., 572 Lowry Medical Arts Bldg., St. Paul. These officers will assume their duties after the Summer meeting which will be held in connection with the Minnesota State Medical Society, May 31 to June 2, 1939.

MISSOURI

The Kansas City Radiological Society.—*President*, L. G. Allen, M.D., 907 N. 7th St., Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—*President*, Paul C. Schnoebelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—*President*, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—*President*, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Associated Radiologists of New York, Inc.—*President*, Henry A. Barrett, M.D., 140 East 54th St., New

York City; *President-elect*, I. J. Landsman, M.D., 910 Grand Concourse, New York City; *Vice-president*, Frederic B. Elliott, M.D., 122 76th St., Brooklyn; *Treasurer*, Solomon Fineman, M.D., 133 East 58th St., New York City; *Secretary*, William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

Brooklyn Roentgen Ray Society.—*President*, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—*President*, Walter Mattick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—*President*, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—*President*, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—*President*, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—*Chairman*, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

NORTH CAROLINA

Radiological Society of North Carolina.—*President*, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast

Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—*President*, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Vice-president*, R. V. May, M.D., St. Luke's Hospital, Cleveland; *Secretary-Treasurer*, Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President*, B. M. Warne, M.D., Doctors Building, Cincinnati; *Secretary-Treasurer*, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—*President*, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; *First Vice-president*, Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; *Second Vice-president*, Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; *Secretary-Treasurer*, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect*, Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; *Editor*, William E. Reiley, M.D., Clearfield. Annual meeting, June 2 and 3, 1939, Bedford Springs Hotel, Bedford, Penna.

Philadelphia Roentgen Ray Society.—*President*, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president*, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary*, Barton H. Young, M.D., Temple University Hospital; *Treasurer*, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—*President*, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; *Secretary*, Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—*President*, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; *Secretary-Treasurer*, Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—*President*, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Vice-president*, Steve W. Coley, M.D., Methodist Hospital, Memphis; *Secretary-Treasurer*, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—*President*, Jerome H. Smith, M.D., San Antonio; *President-elect*, C. F. Crain, M.D., Corpus Christi; *First Vice-president*, M. H. Glover, M.D., Wichita Falls; *Second Vice-president*, G. D. Carlson, M.D., Dallas; *Secretary-Treasurer*, Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—*President*, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president*, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary*, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—*President*, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary*, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—*President*, H. W. Hefke, M.D.; *Vice-president*, Frederick C. Christensen, M.D.; *Secretary-Treasurer*, Irving I. Cowan, M.D., Mount Sinai Hospital, Milwaukee. Meets monthly on first Friday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—*Secretary*, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—*Secretary*, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

PARTNERSHIPS OF RADIOLOGISTS¹

A SEQUEL TO "THE RADIOLOGIST AND THE HOSPITAL,"

1934 YEAR BOOK OF RADIOLOGY

At a meeting of Eastern Radiologists, in Washington, in 1934, I spoke to you on the subject of "The Radiologist and the Hospital" using the hospital relationships of Drs. Groover, Christie, and Merritt as a text. At the request of the editors, this plan of radiological practice was published in the 1934 Year Book of Radiology. We have been surprised and gratified at the interest manifested in it. By way of a progress report, let me say that our hospital relationships have remained practically unchanged during the intervening five years, and so far as I know there are no ominous clouds on the horizon to threaten their continuance. We are still of the opinion that *under suitable conditions* the plan outlined and practised by us for the past twenty years is the best yet devised from the standpoint of the medical profession, the hospital, and the public.

It has occurred to me that you might be equally interested in our partnership relations, inasmuch as they have an important if not indispensable bearing on the hospital plan above referred to.

Two of our group joined forces in 1916. Others have been added from time to time until there are now eight members of the partnership. The average age of the partners is 49 years. I think that 45 years would be about the optimum average age for a group such as ours. We have made it a rule never to take anyone into the partnership until they have practised radiology for at least five years. We have this rule to enable us to appraise more accurately a prospective partner's qualifications. In choosing a partner, one should

have in mind the fact that a partner is not easily discarded.

We have another rule which precludes equal partnership until one has practised radiology at least fifteen years. This may seem arbitrary but it has sound actuarial basis. A radiologist is more likely to reach the peak of his earning capacity after fifteen years of practice than he is before. You might find it interesting to check that statement against your own experience.

At the present time we have no physician employee in our organization unless you choose to regard as employees three Fellows in Radiology, each having a two-year term of service. We consider it risky to continue a physician employee indefinitely on a salary basis when you do not consider him eligible for partnership responsibilities and do not intend to offer him membership in the organization. Under such circumstances the question of exploitation is apt sooner or later to arise.

Our non-professional personnel consists of 16 technicians and 13 clerks. Our entire group, therefore, comprises 40 individuals as shown in the following table:

Physicians (partners)	8
Physicians (fellows)	3
Technicians	16
Clerks	13
Total	40

These are distributed in four units, three of which are in hospitals. We have found it desirable to have one of the more mature radiologists and one of the younger ones teamed together at each place. A physician referring patients to a specialist or other consultant is more than apt to choose one of

¹ Read at the meeting of the Eastern Radiologists, at Washington, D. C., Feb. 10, 1939.

his contemporaries. It may have been this fact rather than one of relative fitness and capability that prompted Sir William Osler's suggestion that physicians over sixty may as well be chloroformed.

and their exact appraisal and proper observance a prime essential. Without them you never know where you are or the direction you are facing. Without at least one in the organization who has a flair for that sort of thing, the

	For the year 1939	For the year 1940	For the year 1941	For the year 1942	For the year 1943
1.	.15747	.15394	.15045	.14583	.14416
2.	.15747	.15394	.15045	.14583	.14416
3.	.15747	.15394	.15045	.14583	.14416
4.	.15747	.15394	.15045	.14583	.14416
5.	.15747	.15394	.15045	.14583	.14416
6.	.11765	.1253	.13275	.14583	.14416
7.	.05	.055	.06	.065	.07
8.	.045	.05	.055	.06	.065
	<u>1.00000</u>	<u>1.00000</u>	<u>1.00000</u>	<u>.99998</u>	<u>.99996</u>
	For the year 1944	For the year 1945	For the year 1946	For the year 1947	For the year 1948
1.	.14166	.13833	.135	.13166	.12714
2.	.14166	.13833	.135	.13166	.12714
3.	.14166	.13833	.135	.13166	.12714
4.	.14166	.13833	.135	.13166	.12714
5.	.14166	.13833	.135	.13166	.12714
6.	.14166	.13833	.135	.13166	.12714
7.	.08	.09	.10	.11	.12714
8.	.07	.08	.09	.10	.11
	<u>.99996</u>	<u>.99998</u>	<u>1.000</u>	<u>.99996</u>	<u>.99998</u>

Shifting of personnel from one unit to another is avoided as far as may be practical. The routine operation of each unit is largely autonomous. Nevertheless, it is essential that a certain uniformity of policy and practice be maintained, and there are, in reality, many things that an individual of the group would not do without the approval of the group. A certain amount of red tape, or good manners if you prefer the term, is essential to the harmonious operation of any group. For instance, one partner should never purchase new equipment or make commitments as to employment or salaries of personnel without the approval of the other partners.

Formal business meetings are held on the first and sixteenth of each month, and special business meetings are occasionally held to thresh out important problems which may arise. Minutes of these meetings are carefully scrutinized and preserved.

Semi-formal clinical conferences are held twice monthly during the winter months. No studied attempt is made to standardize strictly professional practices, but actually these clinical meetings and other informal discussions promote a degree of uniformity.

In the operation of a joint enterprise such as ours, I consider accurate business records

chances of the success or permanence of the organization will be greatly lessened.

Naturally, the first item for consideration in the above connection will be the partnership agreement. The parties to such an agreement should realize that contingencies may arise which it is impossible for them to foresee. If this happens, they should, if possible, settle the matter at issue by mutual agreement rather than by an appeal to the courts. Nevertheless, the partnership agreement should be legal and with that end in view we have from time to time sought legal counsel. Indeed, if one does not understand something of the laws relating to partnership he may quite unexpectedly find himself in the middle of an embarrassing situation.

There are two main parts to a partnership agreement. First, it must set forth the participating interest of the respective partners. In instances in which this is equal and unchanging, this is a simple matter. Where it is unequal and constantly changing, as it has been with us, it is more complex. At the beginning of this year we took into the partnership two of the younger men who had completed their five-year apprenticeship and it was, of course, necessary to amend our partnership agreement. The table on this page shows the

participating interest of the partners, as amended.

A second part of a partnership agreement concerns itself with the settlement of a partner's interest in the event of his separation from the partnership, by death or otherwise. Unless this is specifically and clearly provided for, it is more than apt to become a subject of controversy. This provision must needs be governed by other circumstances connected with the business of the partnership. The joint ownership of property would of course modify the terms of settlement, as would also the debts of the partnership. Our own agreement, as it now stands, provides that the remaining partners shall pay to the retiring partner, or to his estate in case of death, an amount equal to that received by him from the business during the two calendar years immediately preceding his retirement or demise.

You will at once see that this places on the partnership a very real obligation and responsibility which should, and I hope does, impose upon us the necessity of conducting our affairs with a view to its complete fulfillment. It is a matter that requires constant watching and re-appraisal, otherwise our agreement will in the end turn out to be "just another scrap of paper."

I will set down a few of the things which ordinary prudence should prompt us to do and not to do.

(1) We should maintain a cash reserve equal to about 10 per cent of our gross annual income.

(2) We should carry insurance on the lives of all the partners in an amount equivalent to at least two-thirds of the estimated liability under the partnership agreement.

(3) The partnership should not borrow money.

(4) Over-expansion of the partnership should be guarded against.

Disregard of any one of these four items enumerated might make it an onerous task to meet the terms of the partnership agreement and disregard of two or more might make it impossible.

We have one qualifying clause in our agreement which we think is unique. It is as follows: "In the event any partner is absent from the partnership business for any cause other than sickness or physical disability, for any period in excess of 30 days during any twelve-month period, a proportionate deduction for such excess time shall be charged

against his partnership interest for such twelve-month period, the deduction on account of such excess absence to be made from the amount to be paid to him or to his representative as of the time of his separation from the partnership by death, retirement, or otherwise."

There are, of course, other qualifying clauses in our agreement, one of which allows the remaining partners a certain amount of latitude as to the time they may take in settling a retiring partner's interest. To be legal, an instrument of this sort is also presumed to be reasonable.

Inasmuch as none of the partners in our organization has as yet retired or died, what I have said in that connection is not based on personal experience.

As I have previously intimated, adequate and accurate accounting is the best barometer of our business, as indeed it is of any business. Two of our employees devote their entire time to that end of it, and a few facts gleaned from the record may interest you.

Seventy per cent of our gross income is derived from diagnostic and 30 per cent from therapeutic radiology. It is our opinion that more than 50 per cent of our professional time and effort and 50 per cent of our overhead is devoted to the latter branch. This means that it requires two and one-third doctors to earn a dollar doing therapy as compared to one doctor doing diagnostic work. If our experience in this regard is indicative of a general trend throughout the country, as I suspect it is, it might very well lead radiology into economic difficulties that would seriously impair its status as a specialty. Illustrative of what I mean, I do not recall having heard a radiologist read a paper on fractures for many years; very little on the subject appears in radiological literature; and I doubt if many of us, particularly the younger men, take serious interest in it or fully realize that it has been, and still is, from a financial standpoint, the top cream of radiological practice. By way of contrast, I would say that the radiological treatment of cancer, from a financial standpoint, is well-diluted skimmed milk. I realize, of course, that you can cite a few exceptions to the latter statement but these do not invalidate it as applied to the entire radiological picture.

I have not said the foregoing with the idea that we should necessarily take less interest in therapeutic radiology, but that we should take more interest in the ordinary garden variety of diagnostic problem, including technical-de-

tails, which can be fully as difficult and interesting and far more profitable. With respect to technic, for instance, I no longer feel capable of directing it in all of its details and have long felt the need of a chief technician whose responsibility would be to keep our technical work well above the ordinary. I have, on occasion, attended meetings of our national radiological societies, and having a desire to see some superlative technical work, would be chagrined to find it necessary to visit the manufacturers' exhibits in order to do so.

In other words, I am suggesting that if we take the rich top soil of diagnostic roentgenology and use it in a questionable effort to enrich the comparatively barren soil of therapeutic radiology, the entire radiological field is apt to show progressively diminishing profits. I am inclined to think that profits and progress on the whole follow a parallel course and if I am correct in this it would mean that radiological standards would automatically sink to a lower level. I feel perfectly justified, therefore, in warning radiologists not to permit themselves to take a complacent attitude toward the alleged simpler problems of diagnosis. If he gives them the scrupulous attention they deserve he can, to a large extent, prevent their expropriation by other groups of practitioners. In this connection, I am reminded of the biblical character who was appointed to guard an important prisoner. The prisoner escaped, and when the guard was brought to task about it his only defense was that while he "was busy here and there the prisoner was gone." The radiologist's bread and butter practice will likewise vanish if he is too busy "here and there" to guard it properly.

From 1925 to 1937, inclusive, an average of 53 per cent of our gross receipts has gone into the doctor's pocket. Please note that this does not represent the profit of the partnership, because during all of that time some of the doctors were on a salary. This yearly analysis is made primarily with a view to maintaining a proper balance between overhead and professional income regardless of whether the latter was distributed as salary or on a percentage basis. During the 13 years covered by this survey, the highest percentage of the gross income accruing to the benefit of the doctors in any one year was 56 per cent and the lowest, 47 per cent. In actual practice, of course, the relationship of overhead to profits tends automatically to remain fairly steady, but

unless the various items of income and overhead are broken down and analyzed over a considerable period of time, proper adjustment is merely a matter of luck.

I have already indicated that, so far as we are concerned, we ought to pay more attention to the diagnostic end of our business. For accounting purposes, our expenditures are broken down into approximately thirty different items. I will not bore you by discussing all of these. Approximately two-thirds of our overhead or one-third of our gross income is spent for the following items:

Salaries of clerks and technicians	.16
Rent	.10
Photo and darkroom supplies	<u>.07</u>
Total per cent of gross income	.33

Two of the hospitals with which we are connected furnish, and of course own, the permanent equipment of the x-ray department and this figures in the item of rent in the above table. The radiologist is not in a position to deal intelligently with such variations without a comprehensive knowledge of all of the related facts. He must particularly keep in mind that his business is subject to slumps the same as other businesses and that it will be he who will have to pay the penalty for unwise commitments made in prosperous times. With the steadily increasing overhead costs of practicing scientific medicine, it becomes increasingly important for the physician to understand and be guided by sound business practices.

I am sure that many partnerships of physicians are foredoomed to disappointment because they are founded on delusive objectives. Many are founded with the hope that it will enable the participants to make more money and make it easier. This may or may not happen—it is largely a gambling proposition. Another delusive objective is that by forming a partnership you will restrict competition. Actually, your partner is just as much of a competitor as if he had an independent office next door. Another delusive objective is that it will increase volume capacity. Actually, volume capacity per man power is more than apt to be decreased.

The best objective for a partnership, and the one least likely to have a sting of disappointment to it, is that it will enable the participants to do better work. Any other advantage which may accrue should be looked upon as a by-product of the more efficient service they

will be able to render because of the facilities afforded for consultations and conferences, which will in turn tend to compensate and correct each other's deficiencies. Assuming that the group is of high caliber, this will attract a more remunerative clientele and this is the only reason for assuming that group practice has any financial advantage over individual practice. The caliber of the medical group and the caliber of its clientele will automatically find a common level. This is one of several flies in the ointment of the medical co-operative of which we hear so much to-day. A high-class group cannot be made up of mediocre individuals. This fact fits the layman just as much as it does the doctor and no amount of hokus pokus can circumvent it.

Obviously, no hard and fast rules for selecting partners can be laid down, but if the intended implications from what I have said are kept in mind, mistakes are less likely to occur. Talents peculiar to individual members of the group should balance deficiencies of individual members. I use the term "talents" in an inclusive sense. For instance, unpopularity is capable of making one a misfit in almost any group.

I have already indicated that from a strictly economic standpoint our group is overbalanced on the side of therapy. Radiologists cannot continuously provide out of their earnings the subsidy which efficient radiotherapy of cancer requires.

I would never advise anyone with a marked reluctance to take a chance to go into a radiological partnership. To a considerable extent, it is a sporting proposition and one without a liberal streak of the gambling instinct in his make-up had better stick to solitaire. One who has a liking for teamwork is apt to find ample compensation for the restrictions which a partnership imposes. Indeed, most of the restrictions are for the individual's own good, however difficult it may be for him to accept them. Speaking for myself, my partnership relations have been quite satisfactory. I think that my associates feel the same way, and I trust that this circumstance may counterbalance the hazards and objections to radiological partnerships, which I have tried to emphasize.

THOMAS A. GROOVER, M.D.

ANNOUNCEMENT

THE TWELFTH GRADUATE FORTNIGHT OF THE NEW YORK ACADEMY OF MEDICINE

The Twelfth Graduate Fortnight of the New York Academy of Medicine will be held from October 23 to November 3, 1939.

The subject of this year's Fortnight is The Endocrine Glands and Their Disorders. The purpose of the Fortnight is to make a complete study and authoritative presentation of a subject of outstanding importance in the practice of medicine and surgery.

The Fortnight will present a carefully integrated program which will include clinics and clinical demonstrations at many of the hospitals of New York City, evening addresses, and appropriate exhibits. The evening sessions at the Academy will be addressed by recognized authorities in their special fields, drawn from leading medical centers of the United States. The comprehensive exhibit will include books and roentgenographs, pathological and research material, and clinical and laboratory diagnostic and therapeutic methods. It is also planned to provide demonstrations of exhibits.

The subject of the Fortnight will include the following: Historical sketch of the development of endocrinology; physiology of anterior lobe of pituitary gland; hyper- and hypopituitarism; pituitary diencephalic syndromes; physiology of the ovaries; physiology of testes and therapeutic application of male sex hormones; puberty, menstruation, and menopause; pregnancy; therapeutic application of female sex hormones; physiology of the parathyroid; hypo- and hyperparathyroidism; the adrenal cortex; the Cushing Syndrome—neoplasms of adrenal and their clinical relations; overfunction of the adrenal cortex; the adrenal medulla; adrenal insufficiency; relation of diabetes to endocrine system; relationship of endocrines to nervous system; the physiology and principal inter-relations of the thyroid; hyperthyroidism and hypothyroidism; surgical treatment of hyperthyroidism and other diseases of the thyroid gland.

The New York Academy of Medicine provides this program for the fundamental purpose of medical education. Consequently all members of the medical profession are eligible for registration. A complete program and

registration blank may be secured by addressing Dr. Mahlon Ashford, New York Academy of Medicine, 2 East 103 Street, New York City.

COMMUNICATIONS

MINNESOTA RADIOLOGICAL SOCIETY

The program of the Spring Meeting of this Society was so interesting and so largely attended that it seems well worth while to give it to our readers. It began at two o'clock, was interrupted at six-thirty by an informal dinner, after which two addresses were given. The program follows:

Roentgen Kymographic Studies in Cardiac Physiology. Ancel Keys, Ph.D., and H. S. Friedell, M.D., Minneapolis.

A Series of Interesting Duodenal Lesions. H. M. Weber, M.D., and C. Allen Good, Jr., M.D., Rochester.

Bone Atrophy: Report of an Unusual Case. C. P. Truog, M.D., and R. E. Buirge, M.D., Minneapolis.

The Practice of Radiology in Sweden. H. M. Berg, M.D., Bismarck, N. D.

Symposium on Radiation Therapy of Neoplasm of Stomach: Report and Analysis of Cases. C. N. Borman, M.D., A. U. Desjardins, M.D., C. O. Hanson, M.D., R. W. Morse, M.D., Edward Schons, M.D., and K. W. Stenstrom, Ph.D.

Medical Experiences in China. John L. McKelvey, M.D., University of Minnesota.

Observations on Roentgenology in Europe. H. M. Weber, M.D., Rochester.

GEORGIA RADIOLOGICAL SOCIETY

The Georgia Radiological Society held its Fall Meeting at the Macon Hospital, Macon, Georgia, on Dec. 13, 1938. Twenty members were present. The program consisted of: (1) a short business session; (2) a diagnostic round table, during which films were presented and discussed; (3) a paper on "Timing in Radiation Therapy," by Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston, S. C., the guest speaker; (4) a symposium on x-ray therapy of the breast, conducted by Thomas Harrold, M.D., Macon,

Ga. The Society was entertained at luncheon by C. L. Ridley, M.D., Superintendent of the Macon Hospital.

So much excellent material was presented at the diagnostic round table that it was voted to hold an interim meeting in March, 1939, to further discuss the unused material. The invitation of William F. Jenkins, M.D., of Columbus, Ga., and Col. C. A. Stammell, Ft. Benning, Ga., to act as joint hosts to this meeting was accepted.

IN MEMORIAM

ANTOINE BÉCLÈRE (1856-1939)

Men are born, men die, and the world goes on as if their brief existence had not even made a ripple in the current of eternity. For the majority of human beings life is a mere struggle for a more or less precarious existence, and their presence on earth does little more than move the decimal point in vital statistics. But from time to time a man is born who, because of superior physical and mental endowment, because of exceptional opportunities, or because of hard and intelligent labor, may influence his profession in his own country or in the entire world, may affect the trend of science, or may alter the course of history.

When, so recently, news of the death of Antoine Bécère was received, even the younger generation of radiologists outside of his native France, who barely knew his name, were affected because they saw the profound impression which this information produced on their seniors, most of whom well knew the tremendous influence which the work of Bécère has had on the development of medical radiology. His life can be cited as a well-nigh perfect example of the great and widespread effect which intelligent and persistent labor can have on the development of an art or science or on any form of human activity.

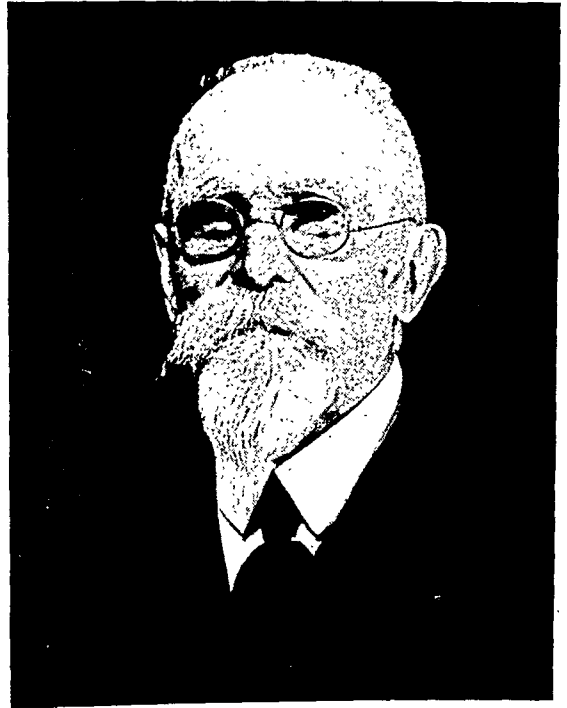
In France, where for so many years Bécère dominated the field of radiology, his death marks the passage of an epoch. In no other country, perhaps, has one man had such a predominating influence on a medical specialty as Bécère has had on French radiology. It was he who trained and inspired most of the present-day leaders in this field. Among the prominent exponents of radiology in France,

few are those who were not his pupils. Belot, Ledoux-Lebard, Maingot, Haret, and many others received from him their instruction in radiology and are now carrying forward the torch which he transmitted to them. During the active part of his career as a teacher, many radiologists from other countries of Europe and America went to Paris to take courses from Bécclère or to observe the work constantly going on in his active service at Saint Antoine Hospital.

Although Bécclère's reputation was based chiefly on his labors as a radiologist, those who are familiar with his long career are aware of the fact that, before turning his attention to radiology, he had already made his mark in experimental medicine and in children's diseases. It was perhaps this already broad experience, together with his keen intellect and mature judgment, which enabled him to proceed so surely and so effectively in applying to clinical medicine and surgery the remarkable rays discovered by Roentgen.

Born in Paris on March 17, 1856, he received his preliminary education at the Lycée Bonaparte (now the Lycée Condorcet). After some hesitation in the choice of a career, he finally selected medicine, and had as his principal teachers: Ollivier, Tillaux, Duplay, Lucas-Championnière, and Pinard. In 1875 his medical studies were interrupted by one year of military service, and in 1877 he began his service as an extern at Beaujon Hospital under Millard. His internship began in 1878, and he became greatly interested in dermatology, ophthalmology, and otology. The fourth year of his internship was spent with Labric, who was an excellent teacher of pediatrics. As a fertile field of study the contagious and epidemic diseases of children fascinated him, and as his thesis he selected "The Contagion of Measles," in which he proved that the disease can be transmitted at its very onset, that the danger of contagion is greatest during the period of oculo-nasal catarrh, and that the danger of contagion disappears with the rash. He also showed that contagion is easily neutralized by air, is quite ephemeral, and disappears spontaneously in a short time. These ideas which are now so well known, were then revolutionary. This thesis (1882) received no attention whatsoever but later Bécclère's findings were confirmed and generally accepted. He also gave close attention to diphtheria and, after having performed 140 tracheotomies, was named monitor of tracheot-

omy. Having to serve as a substitute in the service of Brown-Séquard, he had an opportunity to learn much about the endocrine



The late DR. ANTOINE BÉCLÈRE

glands. He fed with sheep thyroid a patient suffering from myxedema, going each day to the slaughter house to obtain the glands. Thus, he was able to observe the danger of excessive thyroid feeding and described the signs of experimental hyperthyroidism provoked in this manner. He also tested the ingestion of fresh suprarenal gland from calves on Addison's disease.

Still intent on devoting his life to childhood diseases, and having some spare time between 1892 and 1900, he studied the analogies between cow-pox, small-pox, and syphilis from the standpoint of immunity and, in 1895, he was able to show that the serum of young cows which had been vaccinated had a considerable degree of immunity against cow-pox. He also investigated the immunizing power of serum from immunized human beings and animals against the virus of cow-pox. In 1899, he specified the conditions governing the intra-uterine transmission of cow-pox immunity and demonstrated the anti-virulent power of human serum, and applied the results of his investiga-

tions to the treatment of many victims of cow-pox. Moreover, his results were confirmed by others and soon became general knowledge.

In 1896, two friends, Doctors Barthélémy and Oudin, who were the first physicians in Paris to install apparatus to generate roentgen rays, invited their old professors to see the demonstration; only one, Professor Bouchard, came. Bécère, who had also been invited, could not arrive until the end of the demonstration. Nothing would do but his friends must re-examine with Roentgen's rays an old servant. Thus Bécère saw the shadow of the beating heart and aorta, the diaphragm rising and falling, and was astonished to find at the apex of one lung diminished clarity of the pulmonary tissue, possibly because of an old tuberculosis (years ago, this woman had had hemoptyses). He realized at once the great value of this new method of examination. Thenceforth, he devoted himself assiduously to the study of this new branch of medicine. Being familiar with geometry and physics, and having much clinical experience, he made rapid strides. During the very first year, 1896, he inaugurated a course in medical radiology, and for thirty years he gave this continually expanding course to thousands of French as well as foreign pupils.

His knowledge of ophthalmology made him realize at once that accommodation of the examiner's eyes to darkness was essential for a good roentgenoscopic examination, and he sought for years to make physicians in general understand this elementary fact.

In 1897, Bécère was transferred from Tenon Hospital to Saint Antoine Hospital, where he organized a primitive roentgenologic service and where he continued his course of instruction in radiology for physicians and medical students. Here also he devised many improvements in equipment which became standard: combined vertical and horizontal roentgenoscope; iris-diaphragm to control the beam of rays and increase the definition of the image, an incidence indicator; a roentgenoscopic table with the tube beneath the table to permit the examination of patients in the recumbent position; a plate-holding cassette which could be swung instantaneously in place of the fluorescent screen for rapid roentgenography; a spark-gap to measure rapidly in centimeters the length of the spark between two conductors and the use of this measurement as an indicator of

voltage and indirectly of the quality or penetrating power of the rays.

At the outset, in France as in other countries, this new physical technic of examining patients was often taken up by physicists or technicians, and many short-sighted physicians thought it proper to leave roentgenologic procedures in their hands. Bécère vigorously and successfully opposed this tendency and made clear the many reasons why roentgenologic procedures, both diagnostic and therapeutic, must be confined to physicians.

In February, 1897, he published his first communication (with Oudin and Barthélémy) on "The Application of the Roentgen Method to the Examination of an Aneurysm of the Aortic Arch." In 1898, he presented a long report on "Roentgen Rays in the Diagnosis of Tuberculosis," and in 1899 he published a small book on the same subject. In 1900, he presented a communication on the "Diagnosis of Thoracic Diseases," and in 1901 he published a small book entitled "Roentgen Rays and the Diagnosis of Non-tuberculous Diseases of the Thorax." From 1900 he concentrated much attention and wrote extensively on the roentgenologic examination of thoracic and abdominal lesions, including diverticula of the esophagus and urinary calculi; in connection with the latter he advocated stereoscopic roentgenography. Another small book on "Roentgen Rays and the Diagnosis of Internal Diseases" appeared in 1904, and in the same year he contributed two important sections on fluorescent screens and roentgenoscopy and on the roentgenologic examination of the thorax and mediastinum and the diagnosis of thoracic and intrathoracic conditions for the exhaustive "Treatise on Medical Roentgenology" published under the direction of Professor Bouchard. In 1912 he prepared for the French Surgical Society a detailed review of the roentgenologic diagnosis of diseases of the digestive tract. Later he devoted a great deal of attention to the diagnosis of pituitary tumors as well as other brain tumors.

From the very beginning, also, Bécère interested himself in the therapeutic use of roentgen rays. As early as 1902 he called attention to the importance of precise methods of measurement in roentgen therapy. No sooner had Holzknecht, in 1900, presented the first instrument to measure the quantity of the rays, than Bécère went to Vienna to learn this new method. Subsequently, it was improved by Sabouraud and Noiré, who found that

pastilles of barium platino-cyanide were superior for the purpose. From 1904 to 1910 he treated many benign or malignant conditions of the skin, cancer of the breast, and, after Senn's announcement of the value of roentgen rays in the treatment of leukemia, he treated many cases of this disease, of Hodgkin's disease and lymphosarcoma, and closely observed the effect of the rays. In 1908, he began to treat uterine fibromyoma and, during the next twenty years, his extensive writings on the subject had a great influence on the entire medical profession. During the same period he treated tumors of the hypophysis, tumors of the testis, and many other varieties of neoplasm. Although he wrote a great deal, he never wrote hastily. Everything he wrote showed careful preparation of statistics, sound analysis, and conservative but firm conclusions. All his writings were characterized by clarity of thought and expression. His teaching also was marked by simplicity, great clarity, and order, and this is probably why Bécélère had such an influence on radiology not only in France but throughout the world.

When the war of 1914 broke out, Bécélère devoted all his attention to the teaching of roentgenology from the standpoint of its application to military medicine and surgery, and to questions of organization. Having been made director of all departments of radiology by the military government of Paris, he labored so hard and so effectively that, when the war ended, he had organized 120 such departments within the Paris area alone. Besides this task, he also had to train roentgenologists for the imobile hospitals and for the hospitals in the zone of the army. When the American army arrived in France, Bécélère was able to render great assistance to many of our roentgenologists and to help to prepare them for the tasks which they would have to face.

Member of the Academy of Medicine (Paris) since 1908, he was elected President in 1928, and in the same year was selected as President of the Third International Congress of Radiology which was held in Paris in 1931. Then he turned his attention once more to the problem of immunity in syphilis and, after two years' work, he was able to achieve the experimental transmission of syphilis to the bovine species. Thus, at a time when most men seek peace and rest, Bécélère's insatiable curiosity impelled him to continue to seek an answer to old or new problems, and these problems were not confined to the field of radiology.

Bécélère's long and fruitful career is a shining example of what a man can do. He was not "brilliant" in any sense of the word. His achievements were reflections and natural results of the main qualities of his character: curiosity, a keen intellect, an enormous capacity for hard and steady work, tenacity and persistence, and sound judgment. Some might be tempted to add that he was fortunate in entering the field of medicine at a time when radiology was so soon to rise above the horizon, but, without his qualities of character, this circumstance could not have been an important factor.

In Bécélère not only France but the world has lost a great radiologist and a great physician.

A. U. DESJARDINS, M.D.

BOYD E. WILKINSON, M.D.

Boyd E. Wilkinson, M.D., a member of the Radiological Society of North America since 1926, passed away at his home in Paterson, New Jersey, on April 11, 1939, after a heart attack. He was 58 years old.

Dr. Wilkinson, who was on the staffs of the Paterson General Hospital and the Good Samaritan Hospital of Suffern, N. Y., was born in Trevorton, Pa., on June 17, 1880, and attended schools there. He later attended Central Pennsylvania College, the Illinois Medical School in Chicago, and obtained his M.D. degree at Baltimore Medical College in 1905.

He was a captain in the medical corps during the World War and was chief roentgenologist in Evacuation Hospital 15 at Verdun. He moved to Paterson after the war and founded the radiological department at the General Hospital.

Surviving are his widow, Mrs. Louise Wilkinson; a son, Dr. Ralph, and a brother, Samuel, both of Trevorton.

Dr. Wilkinson's former associates extend their sympathy to the family he left.

HENRY SCHMITZ, M.D.

The Editor has received the sad news of the passing of Henry Schmitz, M.D., an honored member of the Radiological Society of North America.

A memorial sketch and portrait of Dr. Schmitz are being prepared for a forthcoming issue of RADIOLOGY.

BOOK REVIEWS

CLINICAL ROENTGENOLOGY OF THE DIGESTIVE TRACT. By MAURICE FELDMAN, M.D., Assistant Professor of Gastro-enterology, University of Maryland; Associate Roentgenologist, Sinai Hospital; Assistant in Gastro-enterology, Mercy Hospital, Baltimore, Maryland. A volume of 1014 pages, and 358 illustrations. Published by William Wood & Company, Baltimore, 1938. Price: \$10.00.

This book is written especially as an aid for the roentgenologist, gastro-enterologist, student, and general practitioner who wishes to learn more about diagnostic roentgenology as applied to the digestive tract. Every phase of the gastro-intestinal tract is covered in a comprehensive and concise manner with the object of presenting the importance of the x-ray examination. The volume is chiefly a compilation of condensed facts and data that have been selected from the literature.

The text is arranged in 220 chapters, each of which contains the essential clinical, pathologic, and roentgenologic data relating to a particular subject. In some places the roentgenologic aspect, which is supposed to be the main theme of the text, is somewhat submerged by a mass of statistical data relating to various clinical phenomena. To the radiologist the general consideration accorded the technic of the roentgen examination and particularly that relating to the technic of fluoroscopy and palpation will seem somewhat brief, although this phase of the subject is amplified in the individual chapters as the occasion arises. A greater number of illustrations would enhance the value of the work for many readers.

On the whole, this is a most commendable text, written from the viewpoint of a clinician, that contains a wealth of information which is pertinent to the successful pursuit of an important specialty of medicine.

OH, DOCTOR! MY FEET! By DUDLEY J. MORTON, M.D., Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University. A volume of 111 pages, well illustrated by photographs. Published by D. Appleton-Century Company, New York and London, 1938. Price: \$1.50.

This interesting and well illustrated book on static foot pain should be popular with the

laity as well as the medical profession because of the clear and instructive manner in which it is written. There are only a few illustrations but they clearly show the importance of x-rays in the diagnosis and treatment of foot complaints. Upon completion of the book, one is convinced that he has been offered a very satisfactory explanation of the causes and treatment of flat, painful feet in association with and without anterior metatarsalgia. It is interesting to note that Dr. Morton points out the harmful effects of exercise in the presence of acute foot symptoms and its probable little effect in chronic pronated feet.

LE DIAGNOSTIC RADIOLOGIQUE DES TUMEURS MALIGNES DU PHARYNX ET DU LARYNX (The Radiologic Diagnosis of Malignant Tumors of the Pharynx and Larynx): **ÉTUDE ANATOMO-TOPOGRAPHIQUE ET RADIOGRAPHIQUE** (A Radiographic and Topographic-anatomical Study). By F. BACLESSE, Chief of the Service at the Curie Foundation, Radium Institute of the University of Paris. Preface by A. Hautant. A volume of 269 pages, and 236 illustrations. Published by Masson et Cie, Paris, France, 1938. Price: 100 fr.

This volume represents one of the finest presentations of any subject that it has been my pleasure to review. The subject matter is arranged in three general parts, as follows: (1) The Normal Pharynx and Larynx. (2) Malignant Tumors of the Pharynx. (3) Malignant Tumors of the Larynx. The normal radiographic anatomy is discussed in 46 pages and here numerous roentgenograms are correlated with diagrammatic sketches. Of particular interest is the chapter relating to ossification and calcification of the normal larynx. In the second part, relating to malignant tumors of the pharynx, the radiographic anatomy and the clinical and radiographic characteristics are given for each type of tumor. The findings in each group before and after radiotherapy are fully illustrated by roentgenograms, diagrammatic sketches, and drawings of the laryngoscopic appearance. The same arrangement is followed for malignant tumors of the larynx which are discussed in Part III.

This text is recommended to all radiologists not only for its excellent presentation of an important subject but as an example of an ideal method of teaching roentgen diagnosis as related to a special subject.

DIE HIRNKAMMERFORMEN BEI HIRNTUMOREN (Deformities of the Ventricles of the Brain Associated with Brain Tumor). By Dr. OTTO DYES, Dozent für Röntgenheilkunde, Würzburg. A volume of 78 pages, and 105 illustrations. Supplement 52, Fortschritte auf den Gebiete der Röntgenstrahlen. Published by Georg Thieme, Leipzig, Germany, 1937. Price: 16.20 R.M. bound.

This is an orderly and very practical consideration of the roentgenologic aspects of ventriculography. The first section concerns the methods of ventriculography and the technic of the x-ray examination. For the latter, the author uses two x-ray tubes, one mounted on the ceiling for exposures requiring a vertical x-ray beam, and the other mounted on a wall for exposures requiring a horizontal x-ray beam. The Potter-Bucky diaphragm is installed in an independent unit, the height of which is adjusted by means of an hydraulic plunger. This arrangement of x-ray devices would seem to be very practical and efficient. As a basis for the discussion of anatomical structures revealed by ventriculography the author has adopted the practical classification of Torkildson and Pirie. Pathologic conditions are considered according to the following classifications:

Symmetrical changes in the lateral ventricles:

1. Posterior horn deformities due to—
 - Occlusion of the foramen of Magendie;
 - Midline cerebellar tumors;
 - Pontine tumors;
 - Stenosis of the aqueduct;
 - Tumors in the posterior part of the third ventricle.
2. Anterior horn deformities—
 - Tumors in the anterior part of the third ventricle;
 - Tumors in the vicinity of the anterior horn.

Asymmetrical changes in the lateral ventricles:

1. Anterior horn defects associated with—
 - Frontal lobe tumors;
 - Tumors of the remaining portions of the cerebrum Zones I, II, III, and IV;
 - Tumors of several zones,
 - Tumors with obstruction of a lateral ventricle.
2. Posterior horn defects associated with—

Temporal lobe and thalamus tumors,
Other hemisphere tumors,
Tumors of the peduncles,
Lateral cerebellar tumors.

3. Intra-ventricular tumors.

4. Cystic tumors.

5. "Early diagnosis."

Dyes' consideration of the subject of ventriculography is not as comprehensive nor as informative as the contemporary monographs by Lysholm, but the illustrations in many respects are superior to those of the Swedish author. Both of these books emphasize the need for an English text concerning this subject.

THE ROENTGENOLOGIST IN COURT. By SAMUEL WRIGHT DONALDSON, A.B., M.D., F.A.C.R., St. Joseph's Mercy Hospital, Ann Arbor, Michigan. A volume of 230 pages. Published by Charles C. Thomas, Springfield, Illinois, 1937. Price: \$4.00.

The use of roentgenograms and roentgenologic procedures has become such an intricate part of the everyday practice of medicine that this special text relating to the medico-legal aspects of the specialty is timely indeed. An endeavor has been made in the writing of this book to collect and comment upon a number of decisions dealing with medicine and the law. The selected cases and citations are those which in some manner or other involve or affect the use of x-ray and the roentgenologist. Decisions are cited covering the essential points and in instances in which differing decisions have been rendered in similar cases, both or all are quoted.

The text is arranged in fourteen chapters, as follows: Introduction, Relationship between Physician and Patient, Malpractice, The Physician and the Law of Agency, Malpractice Defense and Prophylaxis, Evidence and Testimony, Privileged Communications, Expert Testimony, Expert Witness Fees, X-ray Films as Evidence, Ownership of Films, Physicians and Contracts, "Doctor, Take the Stand," and Conclusion. In addition, there is a bibliography, key to citations, table of cases, and index. This book is highly recommended for all physicians and should be popular indeed with members of the legal profession. Many physicians will practise long without knowledge of its contents, others would have practised longer if they had read it.

ELEMENTARY SURVEY OF PHYSICS. By ARTHUR E. HAAS, Ph.D., Professor of Physics at the University of Notre Dame, with the collaboration of IRA M. FREEMAN, Ph.D., Associate Professor of Physics, Central College, Chicago. A volume of 203 pages. Published by E. P. Dutton & Company, Inc., New York City, 1938. Price: \$1.90.

This book offers a concise and comprehensive survey of the whole field of physics. All of the fundamentals of the subject are reviewed, and a precise statement of the newer developments is added.

In discussing each branch of the subject, the author begins with fundamentals, presents and explains the basic generalizations essential to an understanding of modern concepts, touches briefly on all the principal subdivisions in the field, and concludes with a discussion of the recent trends.

A few important but simple mathematical deductions and formulæ are placed in a special Mathematical Appendix. Another appendix is on topics of special interest to premedical students, and a third brief appendix on "Physics and Civilization" is in the form of a concluding summary, and presents a brief account of the importance of physics and its applications in modern life.

This concise and excellent presentation of an important subject is recommended for all those who want to keep abreast of the developments in physics and for those who wish to know something about the fundamentals.

SURFACE AND RADIOLOGICAL ANATOMY. By ARTHUR B. APPLETON, M.A., M.D. (Cantab.), Professor of Anatomy in the University of London and Director of the Department of Anatomy in the Medical School of St. Thomas's Hospital, London; Late Fellow of Downing College, Cambridge; WILLIAM J. HAMILTON, M.D., B.Ch. (Belf.), D.Sc. (Glas.), F.R.S.E., Professor of Anatomy in the University of London at the Medical College of St. Bartholomew's Hospital, London; late Deputy Director of the De-

partment of Anatomy in the Medical School of St. Thomas's Hospital, London, and IVAN C. C. TCHAPEROFF, M.A., M.D., B.Ch. (Cantab.), D.M.R.E., Assistant Radiologist at St. Thomas's Hospital, London. A volume of 311 pages, and 338 illustrations. Published by William Wood & Company, Baltimore, 1938. Price: \$5.50.

The very fundamentals of efficient roentgenologic interpretation demand a thorough familiarity with anatomy and the orderly development of the specialty of roentgenology has resulted from such a correlation. On the other hand, because of the inherent advantages of roentgenologic procedures and the ease with which they can be applied to large groups for investigative purposes there has resulted a tremendous increase in our knowledge concerning the normal and normal variations of many anatomical structures. In medical schools x-ray films have become an intricate part of the anatomy course. For the development of such a close relationship between the two subjects it is not unexpected to find roentgenograms and roentgenologic data appearing with increasing frequency in anatomical texts. Except for specialized texts that have been prepared primarily for roentgenologic purposes, this is one of the first books relating physiology and anatomy in which the radiological application of normal structures has been given a part in the text. It is difficult to understand just why a book concerned with the correlation of surface anatomy has been selected for such a correlation, and surely our knowledge of roentgenology and that of anatomy have been combined to the best advantage in this volume. As far as the skeletal system is concerned, much of the value of the roentgenogram is lost because the usual anatomical descriptions of the bones are not available for comparison. A brief and abbreviated presentation of an important subject may suffice for those for whom the book is primarily intended but certainly it has much more to offer to the student of anatomy than is conveyed by this

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GYNECOLOGY AND OBSTETRICS

Radiotherapy in Non-malignant Uterine Hemorrhage. B. Windeyer. *British Med. Jour.*, 2, 1034-1037, Nov. 19, 1938.

The author discusses uterine hemorrhage, of non-malignant type, under the headings of (1) bleeding at or near the menopause; (2) bleeding associated with fibroids, and (3) bleeding in young subjects.

The effect of radiation is on the ovarian follicles. The more mature the latter, the more sensitive. Hence, the woman in the menopause with mature follicles is benefited by smaller doses than is the younger woman.

Radiation, either by radium or x-ray, is most desirable for the menopause case. The only exceptions are cases of extreme prolapse which would be better handled by surgery for the sake of the gross abnormality. The author discusses the relative merits of radium and x-ray and concludes that the latter is more favorable when available. Factors suggested are 200 kv. at 50 cm. distance with three fields, anteriorly, through a Thoreaus filter. Total dosage is 900 r to each area. Bleeding with fibrosis is treated in like manner. Contra-indications are pressure symptoms, degenerative changes, and unusually large fibroids.

Indications for radiotherapy in young women are debatable. Statistics are cited which would favor moderate doses of radium or x-ray: the author prefers the latter. The possibility of abnormal children resulting from radiation is discussed and one is brought to the conclusion that previous fears regarding monstrosities were unwarranted.

Q. B. CORAY, M.D.

HEART AND VASCULAR SYSTEM

The Concurrence of Radiologic Signs and Electrocardiographic Changes in Myocardial Damage. Friederike Barth. *Schweiz. med. Wchnschr.*, 68, 1376-1379, Dec. 17, 1938.

The author reports 500 cases of cardiac disease in which two-thirds showed a correspondence between fluoroscopic findings (pulsations of poor strength) and electrocardiographic changes, indicating myocardial injury. In one-third there was no agreement; that is, either the E.K.G. showed myocardial changes while pulsations were strong, or the E.K.G. was normal and the pulsations were weak. In cases showing weak pulsations, 96.2 per cent showed electrocardiographic changes, while in those showing poor strength pulsations, 89.3 per cent showed such changes. The author concludes that weak pulsation seen at fluoroscopy is very strong presumptive evidence of severe myocardial damage.

LEWIS G. JACOBS, M.D.

Primary Sarcoma in the Peri-myocardium. P. Cossio and I. Berconsky. *Rev. Argent. de Cardiol.*, 5, 172-181, July and August, 1938.

Cossio and Berconsky report what they think is the

twelfth case ever reported of primary sarcoma of the peri-myocardium, it being the first case reported in the Argentine.

The authors state that primary tumor of the heart is much rarer than secondary tumor and they quote Lymburner's 8,550 necropsies in which he found four primary and 52 secondary tumors. Benign tumors, they find, are four times as frequent as malignant. The authors quote Mendelstam, who, in 1923, made a rather complete search of the literature and found a total of 143 cases, 117 of which were benign.

The essayists state that the neoplasm at times takes origin in the sub-pericardial tissue and from there invades and extends along the myocardium, replacing it without forming tumor masses. When this happens, the real nature of the malady cannot be diagnosed, even if suspected, but if tumor masses are formed, the roentgenological diagnosis is feasible.

One point of special interest brought out in this report is that the clinician is often made aware of the condition and led to the correct diagnosis, during life, by different signs. Gottel, in 1919, diagnosed primary sarcoma of the left auricle on finding of mitral stenosis when the patient was in a standing position and insufficiency when he was in a prone position. Autopsy revealed the neoplasm to be in the right auricle.

In 1924, Bosco diagnosed metastatic sarcoma of the right auricle, in a patient who had a primary lung sarcoma, by finding auricular extrasystoles, a dense shadow of the heart silhouette, and neoplastic tumor cells in the pericardial fluid.

Rösler also, in 1924, diagnosed metastasis to the heart in a patient whose primary lesion was in the cheek when the patient developed auriculo-ventricular block.

Fishberg, in 1930, diagnosed metastasis of the heart when each of three of his cancer patients developed auricular fibrillation, auricular flutter, and angina pectoris, respectively. Williams and Amberg, in 1930, diagnosed metastasis in a patient who developed cardiac insufficiency shortly after a limb was amputated for sarcoma. Smith and Arbor, in 1937, diagnosed metastasis in a patient who developed dyspnea and a pericardial rub and who had been operated upon two years previously for melanoblastoma in the mastoid region, and in another, who developed dyspnea, edema, cardiac murmurs, and electrocardiographic changes, a primary tumor in the liver.

ANTONIO MAYORAL, M.D.

INFLAMMATION

Radiation Therapy in Acute and Chronic Inflammatory Conditions. Henry Johnson Ullmann. *Calif. and West. Med.*, 50, 11-14, January, 1939.

This paper brings to the attention of the physician the various lesions in which irradiation has proven of value. It is well worth reading in order to remember that there are many simple lesions and diseases which respond satisfactorily to properly administered radiation.

The average physician is accustomed to consider radiation only in malignant disease, but he must realize that many times radiation will be of great value to him in the treatment of inflammatory conditions.

JAMES J. CLARK, M.D.

The Roentgen Treatment of Inflammatory Diseases. Gage Clement. *Minnesota Med.*, 21, 847-849, December, 1938.

Clement reviews the factors which, in old equipment, were unstable and unpredictable, and points out that with present-day methods, dosage is so accurately measurable that equivalent energies are obtainable at will.

For many years the value of roentgen therapy in acne, furunculosis, and erysipelas has been well known. Other conditions are becoming recognized as amenable to therapy.

Recent work in Leningrad has shown the importance of the dose-time interval. Small doses given every other day had much better effect than larger doses given every fourth day, although the total amount of radiation was the same. This is readily understood when it is realized that only a short time is required to break down the phagocytic cells of the blood, liberating the antibodies or other substances contained therein. These antibodies act as antitoxins and have definite phagocytic properties after liberation. It must be remembered that the metabolism and function of parenchymal and connective tissues are increased by inflammation; therefore, physically equal doses have much greater effect on inflammatory tissue than on normal tissue.

Roentgen therapy should be started early to be effective. It should not be a last resort measure.

Gas bacillus infection has shown, when treated with x-ray, serum, local surgical procedures, and antiseptics, that in many cases the necessity of amputation has been removed. Kelly and Dowell, in a review of 56 cases, report a mortality of less than 10 per cent.

In the treatment of lobar pneumonia, Powell gives the results of the treatment of two groups of patients. One group received x-ray treatment and the other group was treated with serum. In the group which received serum, the mortality was 15 per cent, while in the group receiving x-ray treatment the mortality was only 5 per cent. These results are explained by the liberation of certain lysins from the infiltrating leukocytes by the action of the roentgen rays. This lysin causes the solution of the coagulum which is the principal component of the consolidation.

Other conditions amenable to roentgen therapy include arthritis, parotitis, bursitis, peritonsillar abscess, pyorrhea, endocarditis, bronchiectasis, puerperal mastitis, peritonitis, localized cellulitis, adenitis, endometritis, and many others.

The author quotes Desjardins, who seven years ago pointed out that the destruction of the leukocytes by x-ray exposure liberates the protective substances contained within them and makes them more effective for defensive purposes than they would be in their intact state.

PERCY J. DELANO, M.D.

THE LARYNX

Laryngocele. W. Likely Simpson. *Ann. Otol., Rhinol., and Laryngol.*, 47, 1054-1060, December, 1938.

A laryngocele is an air sac connected with the larynx. The sac may be either intra- or extra-laryngeal. It may develop in a normal larynx without any pre-existing pathologic condition or may follow such etiologic factors as singing, horn-blowing, glass-blowing, weight-lifting, vomiting, etc. Some cases develop due to a weakening of the wall by some disease such as syphilis, tuberculosis, or tumor.

The author's patient was a male, aged 32. There was a history of injury to the laryngeal region two years previously. A small mass had appeared at the midline of the larynx region and recently this had become larger and slightly reddened. Roentgenograms showed air in the sac and instillation of lipiodol into the larynx also revealed a connection between the sac and larynx. The lesion was removed surgically.

LESTER W. PAUL, M.D.

Radiography of the Larynx, Anterior View, and its Technic. R. Ledoux-Lebard, J. Garcia-Calderon, and Albert Djian. *Bull. et mém. Soc. de Radiol. Méd. de France*, 8, 93-97, February, 1938.

By means of an especially shaped, semi-conical film, adapted to the form of the upper esophagus and pharynx, and inserted into the esophagus, the authors obtain excellent anterior and oblique views of the larynx, free of the vertebral shadows. The method is far superior to planigraphic methods and requires, in addition, only careful anesthesia of the pharynx.

S. R. BEATTY, M.D.

Tumors of the Larynx. Frederick A. Figi. *Minnesota Med.*, 21, 553-558, August, 1938.

The most common benign laryngeal growths, in order of frequency, are: Papilloma, myxoma, cysts, inflammatory masses, epithelial hyperplasia and leukoplakia, angioma, and amyloid tumor. Fibroma, chondroma, and xanthoma occur rarely.

Among the malignant neoplasms, carcinoma is the most common (epithelioma); sarcoma, hemangio-endotheliomas, and adenocarcinoma form a smaller percentage.

Removal of papillomas and electrocoagulation of their attachment by means of direct, indirect, or suspension laryngoscopy offers the best chance of cure. Roentgen therapy and radium are inferior to coagulation. Treatment is similar for myxoma.

Cysts may sometimes be left alone, unless too large. They are usually situated in the vallecula. When removal is necessary, this is done, followed by electrocoagulation.

Singers' nodes are a form of chronic laryngitis. They are usually situated at the junction of the anterior and middle thirds of the vocal cords and are caused by faulty voice production. They may disappear or may have to be removed.

Angiomas may be treated by radiation therapy unless they are causing severe symptoms.

Carcinoma of the larynx is usually classified as extrinsic and intrinsic. The intrinsic tumors are those which spring from the vocal cords, ventricular bands, ventricles, interarytenoid region, and subglottic region. The extrinsic growths are those which spring from the epiglottis, aryepiglottic folds, arytenoid cartilages, pyriform sinuses, and post-cricoid region. The earliest symptom of carcinoma of the larynx is usually hoarseness.

Biopsy is a routine procedure. For lack of it, laryngectomy has been done needlessly.

Without treatment, death occurs in from one to three years. Radical surgery is preferred by the author to radiation therapy, which is reserved as adjuvant treatment. Despite the enthusiastic reports of those who have been employing the Coutard method of protracted fractional radiation therapy, the writer feels that the time is not yet here when surgery can be foregone in the majority of cases.

PERCY J. DELANO, M.D.

THE LUNGS

Non-putrid Pulmonary Suppuration. Marcy L. Sussman. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 22-37, July, 1938.

Suppurative bronchopneumonia is a pneumonitis due to non-putrefactive pyogenic bacteria with the formation of pus in, and sometimes necrosis of, the bronchial walls and pulmonary parenchyma. Commonly, this condition complicates purulent sinusitis, whooping cough, measles, influenza, grippe, and aspiration of a foreign body or secretions, as in post-operative pneumonia.

The clinical course is mild and spontaneous resolution is the usual outcome even when abscesses are present. In the severer cases, single or multiple abscesses, as well as free or encapsulated fluid pockets, may form. Atelectasis and bronchial dilatation may occur, with only the latter as a possible permanent result. The roentgen findings will naturally vary with the type present.

S. M. ATKINS, M.D.

Pathological Physiology of Pulmonary Cysts and Emphysematous Bullæ. Nolan L. Kaltreider and Walter W. Fray. *Am. Jour. Med. Sci.*, 197, 62-77, January, 1939.

The functional studies on six cases of pulmonary cysts and emphysematous bullæ are presented. The majority of the cases had pulmonary fibrosis and obstructive emphysema.

In half the cases, the total and vital capacities are reduced and the residual air only slightly increased. The evidence suggests that in most of the cases, the cyst volume is not included in the residual air. In the remaining cases, the changes are typical of obstructive emphysema, *i.e.*, a marked decrease in the

vital capacity and an increase in the residual air, resulting in a normal value for the total capacity.

The volume of the chest is larger than normal and assumes the barrel-shape characteristic of obstructive emphysema. In about half the cases, there is a slight retention of carbon dioxide and a certain degree of anoxemia. The pulmonary reserve is reduced in cases of emphysematous bullæ and congenital cystic diseases. Dyspnea, the degree of which is closely related to the decrease in vital capacity and the expansion of the chest, may be explained by the mechanical impairment of the respiratory bellows.

Cystic disease of the lung is usually classified as acquired and congenital. The cysts may be unilateral or bilateral, solitary or multiple, and contain fluid or air. The patients in this series had certain things in common; a history of respiratory infection; five had respiratory insufficiency; all had emphysema, fibrosis, or both, and three had paroxysms of bronchial asthma.

Bullæ, the result of emphysema, may produce round shadows in the lungs, and, on the other hand, congenital changes may not appear until later life, if at all. It is often clinically impossible to distinguish between congenital cystic disease of the lung and emphysematous bullæ. In the two roentgenographically similar cases, one patient had marked respiratory embarrassment, while the other had only slight breathlessness after exercise.

BENJAMIN COPLEMAN, M.D.

The Diagnosis of Extrapleural Abscesses. Hans, Gösta Skarby. *Acta Radiol.*, 19, 259-272, September, 1938.

Skarby describes the roentgenological and clinical appearances of five extrapleural abscesses (abscesses between the parietal pleura and the thoracic wall). Four of these abscesses were of tuberculous origin; one was due to staphylococcus infection. Tuberculous osteitis of a rib was present in several cases. The author discusses the differential diagnosis of the disease by which empyemas, endotheliomas, and other tumors of the pleura, pulmonary actinomycosis, etc., must be excluded.

ERNST A. SCHMIDT, M.D.

The Diagnostic Value of Pulmonary Radiography in Primary Tuberculous Angina: Insufficiency of Radioscopy. Louis Weigel. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 533, 534, July, 1938.

In the diagnosis of acute angina, it must be remembered that tuberculosis often manifests itself as a painful infiltration of the palate with dysphagia and later ulceration and membrane formation. The diagnosis is usually made by a process of elimination, *i.e.*, from diphtheria, Vincent's angina, syphilis, etc.

Too often a fluoroscopic examination is made and a report of no pulmonary disease is accepted, when, as a matter of fact, many lesions including miliary tuber-

culosis, commonly associated with tuberculous angina, cannot be visualized on the fluoroscopic screen. The only safe radiologic procedure is radiography with proper technic.

S. R. BEATTY, M.D.

Roentgen Diagnosis of Lung Embolism. Nils Westermark. *Acta Radiol.*, 19, 357-372, October, 1938.

X-ray examination allows a differentiation between pulmonary embolism with infarctation and embolism without infarctation.

In embolism without infarctation, we observe ischemia of the branches of the pulmonary artery distal to the embolus. In the roentgenogram, this ischemia appears as a clarified area with a diminution of the vascular pattern in the region supplied by the occluded artery. In the central portions of the lung, however, the vascularization is maintained. The border between vascularized and non-vascularized areas is sharp, but the phenomenon is of transient nature and may change within a relatively short time.

In embolism with infarctation, the typical wedge-shaped area of radiopacity is pathognomonic, but even in cases in which infarctation is present, other parts of the lung may show larger or smaller wedge-shaped clarifications pointing to simultaneous embolisms without infarctation.

ERNST A. SCHMIDT, M.D.

Lung Abscess Due to Esophageal Overflow. D. Alan Sampson. *New England Jour. Med.*, 219, 982-985, Dec. 22, 1938.

Sampson reports a case of chronic lung abscess with the classical findings but, in addition, there were gastric complaints, which, upon investigation by means of a barium meal, revealed a greatly dilated esophagus due to cardiospasm. It is believed that overflow of the esophageal contents resulted in the pulmonary infection.

Review of the pertinent literature reveals that a pulmonary abscess may, in addition, result from a foreign body in the esophagus, pulsion diverticulum, carcinoma of the esophagus, or a benign structure. These are conditions to be investigated when a cause is sought for lung abscess.

JOHN McANENY, M.D.

The Association of Silicosis and Carcinoma of the Lung. Max O. Klotz. *Am. Jour. Cancer*, 35, 38-49, January, 1939.

An extensive review of the literature on this subject is presented, together with four additional case reports of patients dying with both carcinoma of the lung and pneumoconiosis. The literature is divided as to the possible carcinogenic influence of silicosis, but the tendency is to support the contention that silicosis or other forms of pneumoconiosis may play a part in the production of primary carcinoma of the lung.

The author's four cases were found among a group of 50 autopsies on patients with pneumoconiosis, an

incidence of 8 per cent. This was compared to an incidence of 53 cases of carcinoma of the lung in 4,500 routine autopsies, or 1.17 per cent. This suggests some factor in silicosis which predisposes to the development of carcinoma of the lung.

Although the tumors were large, in three of the four cases, none could be diagnosed by roentgen examination even in retrospect.

H. O. PETERSON, M.D.

Tuberculous Ulcerations of the Lung and Pulmonary Cavities. Bruno Faccini. *Arch. di Radiol.*, 14, 279-303, 1938.

This is a discussion of the differential diagnostic roentgenologic features of these lesions, with characteristic roentgenograms.

E. T. LEDDY, M.D.

The "Azotemic Lung": Radiographic Study. C. Roubier. *Jour. de méd. de Lyon*, 19, 467-473, Aug. 5, 1938.

The author calls attention to certain radiographic findings in the lungs of those individuals suffering from nitrogen retention. This consists of the appearance of spots, more or less confluent, giving a dappled or flocculent effect, which predominate in the mid-lung or parahilar regions and are, in certain cases, localized to the right lung. Such a picture naturally makes one think of tuberculosis, especially as certain spots with relatively clear centers simulate cavities.

These lesions are essentially regressive, disappearing progressively as the blood urea returns to normal.

The anatomico-pathologic substrate is a pronounced pulmonary edema without other macroscopic lesion. Histologically, there is found an intra-alveolar serous exudate, with, at times, some inflammatory cells.

S. R. BEATTY, M.D.

Congenital Lung Cysts: Air Expansile Types. William Willis Anderson. *South. Med. Jour.*, 31, 628-632, June, 1938.

Two cases of lung cysts are reported. This type is assumed to be congenital in origin. It starts as an intrapulmonary fluid sac, lined with secreting epithelium, increases in size, particularly during pulmonary infections, and ruptures into a bronchus, forming an air trap into which air can enter but not escape.

Roentgenographically, it may be confused with emphysematous blebs, or, when extremely large, with a pneumothorax. Fluid cysts before rupture should be suspected in atypical pneumonic processes and such cases should have chest roentgenograms made at the end of their acute stages.

The prognosis of air-expanding cysts is grave. A high percentage occur in infancy. The use of the thoracoscope and cauterization of the aperture with sclerosing solutions is a logical form of treatment and surgery will probably reduce the high mortality rate in the future.

JOHN M. MILES, M.D.

The Division of the Lung Segments in the Right Upper Lobe. E. Behr and Felco Huizinga. *Acta Radiol.*, 19, 399-407, October, 1938.

The investigation of the right upper lobe in 108 lungs showed that no fixed scheme for the ramification of the bronchial tree and the division into lung segments exists. However, a particular type of ramification, a trifurcation, occurs most frequently, although the anatomical variations are numerous. In about 40 per cent of the examined lungs, a bifurcation was found in the right upper lobe.

The author concludes that if in any clinical case a definite knowledge of the anatomical conditions and relations is required, it is impossible to rely on any theoretical considerations but bronchography must be resorted to.

ERNST A. SCHMIDT, M.D.

Radiographic Studies of the Excretion of Dusts from the Lungs. A. E. Barclay, K. J. Franklin, and R. G. Macbeth. *British Jour. Radiol.*, 11, 405-413, June, 1938.

The authors' first study was undertaken to extend their knowledge of the efficiency of the ciliary action in the bronchial tree in removing small particles of inhaled dust. The normal mechanism for removing inhaled dust consists of the ebb and flow of air in the bronchi, the action of the cilia, and coughing. Coughing cannot be regarded as a normal mechanism of removing dust from the finer bronchi as it is the result of irritation in the upper respiratory passages and removes mucus which contains suspended particles; it is primarily a reserve mechanism. The ciliary action is by far the most important normal mechanism. The normal defensive mechanism of the lungs is exceedingly effective in preventing dust from reaching the alveoli.

India ink, placed in the main bronchus of a sheep's lung not far from the tracheal bifurcation, very quickly crosses the bifurcation. It apparently divides at the bifurcation, one stream going up the right, and the other to the left into the trachea. In the trachea the particles move in a spiral manner, clockwise. A similar drift was noticed in a cat's trachea. India ink injected sub-pleurally into a cat appeared in the upper trachea in 14 minutes, during which time it had travelled 12 cm.

Ciliary action is impeded if there is too little or too much mucus. Furthermore, if the mucus is too thick, the cilia cannot move it freely. The cilia may be destroyed by inflammatory conditions which will seriously interfere with removing dust from the lungs. The ciliated epithelium disappeared near the border of the bronchioles of 0.2 mm. in diameter.

Experiments were performed on cats. Two types of opaque dust were used, bismuth carbonate and powdered lead glass. With the assistance of a laryngoscope, a small tube was passed into the trachea to the bifurcation and the dust blown in with an insufflator under fluoroscopic control. In each instance, the dust was seen to go only to the smaller bronchioles; it did

not penetrate the alveoli. The radiographic examinations were made, subsequently, to see how rapidly the dust was excreted. Two observations were made; the time in which most of the dust was removed, and the time when the last trace disappeared. The figure for the disappearance of dust was quite reliable, and was checked with postmortem examinations.

In 14 instances using bismuth subcarbonate, the mass of dust had disappeared in 40 minutes and the lungs were clear in 20 hours. Fifteen cats were insufflated with powdered lead glass. This dust was eliminated considerably faster than bismuth carbonate, complete clearing occurring in some cases in about half the time. Repeated insufflations of dust did not affect the speed of excretion.

The addition of 2 c.c. of 1:20,000 acetic acid into the lungs *before* the dust was insufflated did not slow up excretion; however, when 2 c.c. of 1:20,000 acetic acid or normal saline was insufflated *after* the dust, or the dust suspended in saline, spreading of the dust particles into the alveoli was caused, and the excretion was much prolonged.

After the animal was killed, this lung was found to be nothing but a fibrous mass, due, the authors believe, to shrinkage and collapse of the lung caused by disuse.

SYDNEY J. HAWLEY, M.D.

THE MASTOID

Acute Mastoiditis. J. G. Parsons. *Minnesota Med.*, 22, 12-14, January, 1939.

The most commonly met picture in acute mastoiditis is post-aural pain, tenderness, and discharge which has been present for some time before the onset of the other symptoms and which has lessened just prior to their onset.

The most common avenue of infection of the middle ear is through the eustachian tubes, by continuity of tissue from an infected naso-pharynx, the infection being forced through a patent tube by blowing the nose, coughing, sneezing, or vomiting. The infection may also be carried by blood and lymphatics.

Infection of the middle ear practically always means infection of the mastoid antrum, where germs of a more virulent type find their way to the mastoid air cells.

Adequate drainage of the middle ear is an important step in heading off mastoiditis. One of the fallacies commonly met with is that there is no great danger of mastoiditis if an ear is draining freely; it is essential to see the drum head and note the size of the opening.

Post-auricular edema is an important sign. The most important condition to be differentiated is furuncle of the external canal.

An ear which has been discharging for more than a week, without diminution, should be held under suspicion.

In the discussion it was pointed out by Dr. Walter E. Camp that one type of acute mastoiditis was especially treacherous—that in which there was a minimum of clinical symptoms, *i.e.*, slight pain and discharge;

and that this type, which might go on to meningitis, showed only slight cell destruction on x-ray examination.

For correct diagnosis repeated x-ray examinations are often necessary.

PERCY JOSEPH DELANO, M.D.

PEPTIC ULCER

The Radiologic Characteristics of the So-called "Large Duodenal Ulcer." D. S. Bartstra. *Acta Radiol.*, 19, 352-356, October, 1938.

While, in general, the size of a duodenal ulcer varies between a barley grain and a bean, the so-called "large duodenal ulcer" may assume the size of a walnut. In spite of this large size, the niche often escapes radiological detection. This may be explained in some cases by the marked duodenal deformity; in other cases the large ulcer niche is misinterpreted as a duodenal bulb.

A case is described which illustrates the essential diagnostic features, especially with regard to differentiation from a duodenal bulb.

ERNST A. SCHMIDT, M.D.

Double Ulcer of the Stomach: Radiographs and Specimen. Vincent Paschetta. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 343, 344, May, 1938.

Radiographs of a case demonstrated an atypical niche of the lesser curvature and a deformed bulb, which, to the examiner, indicated a duodenal ulcer. Operation showed a perforating ulcer of the lesser curvature, a smaller ulcer of the lesser curvature, not seen on the radiographs, and peri-duodenal adhesions caused by the larger ulcer of the lesser curvature.

S. R. BEATTY, M.D.

Peptic Ulcer of the Esophagus. Flemming Norgaard. *Acta Radiol.*, 19, 458-464, November, 1938.

As the author points out, peptic ulcer of the esophagus is a rather uncommon disease and the cases in which it has been diagnosed primarily by roentgen examination are not frequent. However, the roentgenogram reveals characteristic changes which should not be overlooked in routine examination of the esophagus. The most common observation is spasm; occasionally broad folds of mucosa are seen, indicative of esophagitis. Contrast-filled ulcer niches can be demonstrated only rarely but the combination of spasm and niche must be considered pathognomonic. It is extremely important that in doubtful cases the examination be repeated several times, especially during periods of exacerbation of the symptoms. Such exacerbations may be provoked artificially for the purpose of x-ray study.

Norgaard reports the case of a seven-year-old girl whose first symptoms (vomiting) dated back four years. The radiologic examination showed esophageal spasm and dilatation without evidence of cicatrization. A later examination revealed a contrast shadow of small

pea size, projecting slightly to the side of the lumen at the level of the tenth thoracic vertebra. Surrounded by a rarefied annular zone, it gave the appearance of an ulcer niche. Esophagoscopy failed to furnish further details due to bleeding. Under sodium bicarbonate treatment, and after introduction of duodenal sounds, the patient's condition improved remarkably, though milder recurrences continued to appear.

ERNST A. SCHMIDT, M.D.

The Problem of Gastroduodenal Hemorrhage. Albert M. Snell. *Minnesota Med.*, 22, 15-24, January, 1939.

The commonest cause of gastro-intestinal bleeding is duodenal ulcer. Less common is secondary anastomotic or recurrent ulcer. Gastric carcinoma is third in order of frequency.

Gastroduodenal hemorrhages seem, in some cases, to follow sudden physical exertion; in others, abuse of alcohol; acute infections may be a cause, and a fourth reason is possibly vitamin deficiency. The antihemorrhagic vitamin K must be given consideration under this heading.

Many of the bleeding ulcers are of the so-called silent type in that they produce few symptoms at the time. Other patients do have prodromal symptoms of a dyspeptic nature.

Regeneration of blood, after the hemorrhage has ceased, requires about 33 days.

At Guy's Hospital, in London, only 25 deaths from bleeding peptic ulcer occurred in 20 years, whereas the mortality rate in Scandinavian countries seems to range between 10 and 15 per cent. At King's County Hospital, in Seattle, the mortality rate is about 20 per cent. At the Cincinnati General Hospital the rate is 14 per cent. Goldman's mortality figures (San Francisco) show 11 per cent. The mortality rate in the Mayo Clinic is now about 5 per cent.

There is some evidence that hemorrhage from a gastric ulcer is more likely to result fatally than one from the duodenum.

The more serious types of bleeding occur in older individuals; the average age at which fatal hemorrhage occurs is 56 years. In patients past 50 years of age the mortality rate in the Massachusetts General Hospital is approximately 33 per cent. In older patients the eroded artery is often sclerotic.

Individualization of treatment is important; slight degrees of bleeding are usually controlled by conservative measures but more extensive bleeding requires maintenance of blood volume and renal function. Massive or arterial hemorrhage can rarely be controlled except by surgical attack.

The early administration of food after a hemorrhage is receiving more and more favorable consideration; the filled stomach probably has less peristaltic activity than the empty one. It is the practice at the Mayo Clinic to withhold food for from 24 to 48 hours, or until such time as evidence of rapid loss of blood is no longer apparent. After this period, small hourly

He believes that chronic pneumonia is characterized primarily by alveolar exudate, and, secondarily, by the possible development of fibrosis and suppuration. The involvement may be chronic from the beginning. Resolution may occur at any stage, with more or less fibrosis. Fatal cases have simulated tuberculosis both clinically and roentgenographically. Autopsies revealed widespread foci, having an unusual variety of modes of progress and spread, early and resolving consolidations, organization, and suppuration, in different lesions and in different parts of the same focus. These cases seem to establish chronic pneumonia as a clinically recognizable cause of protracted, progressive, or recrudescing disease. Scattered foci are rare, but a large number of more circumscribed pulmonary inflammations may have the above pathologic basis. A rarer giant-cell type of organizing pneumonia and the chronic phase of Friedländer pneumonia are cited.

Chronic Circumscribed Non-suppurative Pneumonia.—This group includes the usual delayed resolution of acute pneumonia. Resolution may require as long as 85 days. The eventual clearing may be complete, with little or no fibrosis. Therefore, consolidation may have prolonged suspended activity. It may arise insidiously or mildly and yet finally completely resolve, which may be most confusing clinically.

Chronic Suppurative Pneumonia.—Fibrosis or suppuration may occur instead of complete resolution. Suppurative symptoms are prominent, but gross abscess, if present, is incidental to the course of the disease. The pathologic features are irregular consolidation, incidental small abscesses, and fresh spreading consolidations, which may or may not excavate. The spread may wander spectacularly.

Pulmonary Abscesses of Obscure Origin.—Such abscesses constitute from 14 to 35 per cent of the total. Symptoms of abscess are dominant. At autopsy, the chronic pneumonic changes are apt to be considered secondary, but recognition of this underlying pathology helps explain the puzzling behavior of these cases.

Etiology.—Chronic suppurative pneumonia seldom follows acute pneumococcal pneumonia, though rarely a benign apurid necrosis may occur. The author has found *Staphylococcus viridans*, gram-negative diplococci, non-hemolytic streptococci, *S. aureus*, pneumococci, *H. influenza*, Vincent's spirochetes and fusiform bacilli in his cases. The clinical courses and bacteriology did not correlate; even Vincent's organisms appeared to be secondary invaders.

Treatment.—The treatment of non-suppurative cases is general and symptomatic. Suppuration without gross abscess may benefit by continuous postural drainage. Localized abscess, without bronchial evacuation, requires surgical drainage, but the results are less satisfactory than with abscess of known etiology.

Arsenicals have shown the author only temporary improvement, even in cases in which Vincent's organisms were numerous. Sulphanilamide was ineffective in two cases. Blood transfusion is important when a falling hemoglobin cannot otherwise be restored.

RAY A. CARTER, M.D.

PNEUMOTHORAX

The Regression of Contralateral Tuberculous Lesions after Monolateral Therapeutic Pneumothorax. V. de Luca. *Minerva Med.*, 1, 321-329, March 28, 1938.

From a study of 99 cases the author feels that monolateral pneumothorax in the majority of instances has a favorable effect on contralateral lesions, but exudative forms may show only a transitory benefit.

E. T. LEDDY, M.D.

Bronchographic Observation of Re-expanded Lungs Following Artificial Pneumothorax. Giuseppe Zorzoli. *Radiol. Med.*, 25, 881-897, October, 1938.

The author believes that in collapse therapy the time of re-expansion is most delicate, and he has made a lengthy bronchographic study of re-expanded lungs which were subjected to the treatment for cure of tuberculosis.

He quotes extensively from different workers who have done experimental pneumothorax in healthy animals, and notes what is generally believed, *i.e.*, that in healthy lungs pneumothorax causes no appreciable permanent damage even if long-sustained; while in re-expanded tuberculous lungs, bronchial dilatations are frequent. The author cites words of Montanini, who, in 16 cases, found 10 with marked bronchiectasis, and in 62 per cent of these it was located in the lower lobe.

In the pleura the changes were layers of fibrous deposits over the membrane, which, when it became organized, interfered with the expansion of the lung.

This writer, going into the subject of his paper, presents bronchographic findings of the changes brought about in the parenchyma, bronchi, and pleura by the collapse in tuberculous and non-tuberculous patients.

In 25 patients, 27 lungs were collapsed. Of these, 16, or 58 per cent, showed bronchiectasis and in 67 per cent of those showing bronchiectasis, the lesions were limited to the upper lobe. In all but two cases the ectasia was cylindrical in type, the two exceptions being saccular. In these two, however, there was suspicion that the dilatation antedated the collapse.

The fact that most of the dilatations were found in the upper lobe was of special interest, because the lower lobe is generally believed to be the site of predilection for this lesion. The reason for the discrepancy appears to be due to the difficulty of diagnosing the condition in these lobes, clinically, as well as in plain roentgenograms, because there is no retention of the secretion due to good drainage, and because bronchography of this region presents technical difficulties.

From these data, it is evident that there is much discrepancy between the author's findings and those of Montanini. The latter, however, was based on pathological specimens, and he found only one case of bronchiectasis of the upper lobe in 16 cases reported.

The author does not believe that this discrepancy is due to dilatations produced by the oil injected, nor to

errors in technic, but believes the difference to be in the material used in the studies.

In seven of the eight cases of basal bronchiectasis, the collapse was done because of lesions at the apex. In the eighth case the lesion for which it was instituted was a progressive capillary advancing tuberculous bronchopneumonia. It is evident, therefore, that there is no definite relation between the site of the old tuberculous lesions and bronchiectasis. Hence it becomes necessary to invoke collapse and consequent re-expansion as the etiologic factor of producing bronchiectasis in healthy lungs.

While studying pathological specimens of collapsed lungs, we have seen how the compression can cause atelectasia of the alveoli, especially of those in the peribronchial region where they are compressed against the rigid bronchial tubes. In these atelectatic zones, the alveoli become so matted together that they always initiate carnification of the lungs. This, at the period of re-expansion, presses on the bronchial walls thereby narrowing the lumen. When to this extrinsic force is added the intrinsic trauma of deep inspiration and cough, the necessary requisites to cause bronchiectasis are found, as the defensive action of the normal alveoli is lacking. These mechanical factors are aggravated by retained sputum which causes inflammation of the bronchial mucosa.

CONCLUSIONS

Bronchial dilatations, more or less marked, with dislocation of the bronchus showing alterations in its branches, occur frequently in the re-expanded lung (58 per cent).

The bronchiectasis could be due to the lesion, for the cure of which it was instituted, or by the pneumothorax itself.

In the re-expanded lung, bronchiectasis is more common in the upper lobe (68 per cent).

Bronchiectasis at the apex is irregular and tortuous, showing alternating narrowings and dilatations resembling a multiple hour glass, while at the bases the bronchi nearly retain their primitive position and the dilatations are cylindrical.

The duration of the collapse appears to have no bearing on the production of bronchiectasis. It does appear, however, that the time the lung has been re-expanded is very important, in the sense that the dilatations are more apt to appear as a late complication. Special care should be exercised during the period of re-expansion, because if a rapid expansion is allowed bronchiectasis is more likely to develop than when the re-expansion is done gradually and slowly.

ANTONIO MAYORAL, M.D.

RADIATION

Superficial Radiotherapy: Contact Radiotherapy (Chaoul). W. Gassmann. Bull. et mém. Soc. de radiol. méd. de France, 26, 534-540, July, 1938.

The general trend in radiotherapy has been toward a decrease in wave length and an increase in depth dose

obtained by the use of higher voltages, increased filtration, increased tube distance, and cross-firing. Even with voltages sufficient to give wave lengths in the neighborhood of those of radium, the results to date have not demonstrated that ultra short roentgen rays produce clinical results equivalent to those of radium. Moreover, there is ample evidence that there is no selective action of short wave lengths *per se*.

The chief differences between roentgen therapy and radium therapy, aside from the difference in wave length, are in (1) geometric distribution of the energy, (2) the time factor, and (3) the total dose.

With these points in mind, Chaoul has devised a method of applying roentgen rays at very short focal-skin distances employing relatively large doses. Fractionation of the dosage is retained, but the time of the individual exposure is less, as protraction of the dose is regarded as of less importance than fractionation and the short time is not only economical but convenient, in that it facilitates treatment in the buccal cavity, vagina, rectum, etc.

A special tube is employed, completely shock-proofed, with the anode at extremity of the tube and at ground potential. A focal-skin distance of 5 cm. can be obtained with a consequent rapid decrease in the depth dose which, combined with a small field (20 cm.² maximum) allows a very high total dose with a minimum of injury to normal tissue.

The voltage employed is 60 kv., the filtration 0.2 mm. Cu, and the rate from 100 r to 150 r per minute. Daily doses of 500 r are given. With small fields, total doses of from 8,000 to 10,000 r may be given; with larger fields the doses should not exceed from 6,000 to 7,000 r.

Chaoul has used this method for six years and the author has had the opportunity to observe his cases. In cases of carcinoma of the lip and skin there has been 95.4 per cent cure of the primary lesion. The results in melanosarcoma surpass those of any other form of radiation therapy. The results in other lesions have been so good as to lead Chaoul to attempt the treatment of deeper tumors by surgical exteriorization. In 14 cases of inoperable rectal carcinoma, the coccyx and sacrum have been excised and the rectum split, to allow direct irradiation. Later the colostomy is closed and the rectum resected, the bowel then being sutured to the anus. Twelve of these cases have, to date, no evidence of recurrence or metastasis. One case died of a concomitant disease. A similar procedure has been tried in cancer of the bladder.

The method of Chaoul is superior to other methods of roentgen therapy and a more universal trial of this method is urged.

S. R. BEATTY, M.D.

RADIOLOGY, PRACTICE OF

Discussion on the Planning and Organization of a Radiological Department in a General Hospital. Proc. Royal Soc. Med., 31, 1081-1096, July, 1938.

Dr. R. S. Paterson: The x-ray department should

be located as centrally as possible, on a ground floor, to serve equally well the wards, the orthopedic department, and the out-patient department. The author says: "I would be much more ready to consider some forms of decentralization than I would have been ten years ago." Subdivision in the department, with rooms and, sometimes, special assistants for special types of work, is better than allocating x-ray equipment among special services outside the department. The latter is uneconomical; service and quality of work would suffer. Yet specialty needs cannot be served in a department already loaded with routine, since considerable time per patient is often required. A small operating amphitheatre with sterilizing and anesthetic rooms in the x-ray department would best care for bronchoscopic and urologic examinations, insertion of pins, injection of arteries, etc.

Regarding dissociation of radiodiagnosis and radiotherapy the author recognizes three schools of thought: (1) Those who would completely separate radiotherapy and radiodiagnosis as having nothing in common; (2) those interested only in cancer, who would treat all cases independently of the x-ray department or the hospital, and (3) those who think radiotherapy and radiodiagnosis should be combined in general hospitals.

The author believes considerable separation must come but that there is sufficient in common to justify location in the same building with much of the staff in common, especially lay and technical.

Physical equipment should include a central waiting hall, accommodating about fifty patients with proper lavatory facilities, and at least twelve small dressing cubicles, six for male and six for female patients. Instead of several large machines (four and six valves) the author prefers a number of one- and two-valve sets in small rooms with a radiographer each. Most of the work can be handled by small sets, only one large one being required. The keyrooms are the darkroom and the office through which all work must go. The author prefers several small intercommunicating darkrooms, centering about a wet viewing room and drying room, rather than one large one. The washing tanks should be designed to push through the wall into the wet viewing room. He would prohibit entrance to the darkrooms during working hours. Films are to be seen in the wet viewing room and dried in the drying room, which the author thinks less expensive to build than to buy commercial drying cabinets.

Dr. Paterson finds a demand for clinical photography in his department but believes it better to handle this in an especially equipped studio and darkroom.

In general hospitals, the x-ray department becomes more and more costly. The author would have a full-time almoner to interview all patients in order to exclude those who are above scale and to collect a partial payment from those who can afford something toward the cost. The unnecessary examination also increases cost and finds its source in the increasing

tendency to use the x-ray department as a sorting station before clinical methods, and the over-enthusiasm of junior residents to have everything radiogrammed before their chief orders it. This is incompletely solved by having a senior resident or member of the honorary staff sign requisitions.

Therapeutic equipment should include deep therapy, superficial therapy, and possibly Chaoul apparatus. It is absolutely necessary that beds be allotted to the department in view of modern protracted therapy.

The author would have either an honorary radiotherapist and an honorary radiodiagnostician or a director with an assistant honorary radiotherapist and assistant honorary diagnostician. These should have full-time paid assistants at the rate of about one per 10,000 cases annually.

The lay staff should be in charge of a nurse. Radiographers should number about one per every 5,000 to 6,000 cases a year. This might be reduced if a training center were established in the department but then the problem of teachers arises. The Society of Radiographers should issue some type of teaching certificate which the senior staff radiographer should have. The darkroom staff should be composed of trained photographers rather than radiographers and should number one for every 10,000 to 12,000 films a year.

Teaching senior students requires that senior radiologists have sufficient assistants to provide the necessary time. This department and staff would also provide every facility for research. One shorthand-typist per 10,000 reports is the minimum, which must be exceeded for really adequate records and follow-ups.

The above set-up is not over-elaborate since the x-ray department is probably the largest auxiliary service supplied by the hospital. In his hospital of 69,762 patients, 30,000 were referred to the x-ray department, and of 12,657 in-patients, 9,000 were referred.

Dr. J. Struthers Fulton: Radiotherapy is assuming a rôle of increasing importance in modern medicine. Radium therapy has, unfortunately, become somewhat divorced from x-ray therapy. If radiology must divide, this should occur between diagnosis and treatment. In a 600-bed hospital, about 20 beds are in constant use for radiotherapy. These should be in a unit, under the control of the radiotherapist.

The author gives a plan based on a floor space of 30 X 200 feet. The primary consideration which determines the layout is the provision of adequate protection to the staff. Full use is made of distance and powerful sources of radiation (radium beam, 400 kv. plant and 200 kv. plants) are placed as far toward the ends of the department as possible. Facility in routine follow-up of cases should be obtained by the arrangement.

The author suggests, as apparatus, a five-gram radium beam unit, a 400 kv. plant and two 200 kv. plants, each of the latter operating two tubes in parallel and wired so that each machine could operate all four tubes. Provision for a radium safe (capacity 1 gm. in needles and tubes), a radium preparation room, mould

room, and dosage-calculating room are included. Waiting rooms in most hospitals are inadequate and this condition should be corrected.

Dr. R. J. Sankey: The value of radiologic service is in proportion to its liaison with clinical services. The department should, therefore, be as near the center of clinical work as possible, for easy co-operation. The least a clinical staff can do is to furnish a tentative diagnosis or clinical notes, when discussion is not possible. Spot diagnosis from radiographs should be a thing of the past. With growing experience the radiologist is less prone to be dogmatic and more anxious to discuss cases before drawing conclusions.

One radiographic room is needed for every 100 beds but figures from hospitals are given showing 157 beds per room. The out-patient volume also must be considered. Division of work is discussed, each room being fitted for some special type. A special investigation room is valuable.

RAY A. CARTER, M.D.

RADIUM

Biological Effects of Alpha Rays, with Special Consideration of the Problems of Radium Therapy Using Extremely Low Doses. K. Inouye. *Strahlentherapie*, 64, 175, 1939.

The author studied the effect of very small doses of radium on fibroblasts and sarcoma in tissue cultures. The medium contained 2.55×10^{-6} grams radium element per c.c. The metabolism of the cultures was determined according to the method described by Warburg. A definite relationship could be established between the dose and the metabolism. The effect of the radiation in the author's experiments was dependent upon the temperature.

Additional experiments were undertaken in humans, who were given baths containing radium emanation varying from 17,000 Me. to 60,000 Me. (Mache-units). The leukocyte and differential count were used as indicators. Four to five hours following a single bath a definite leukocytosis developed, followed 20 hours later by a leukopenia. Slight changes in the differential count were observed sometimes after one, with certainty after several baths. A definite correlation existed between the emanation found in the air expired from the lungs, or, in other words, between the emanation concentration in the blood and the variation in the leukocyte count.

ERNST A. POHLE, M.D., Ph.D.

Radium Therapy of Bladder Carcinoma: Five-year Results, Failures, and Future Therapy. Benjamin S. Barringer. *Jour. Urol.*, 40, 606-611, November, 1938. At the Memorial Hospital, New York City, 215 cases of bladder carcinoma treated cystoscopically and by suprapubic implantation, show three-year cures in 69 cases (32 per cent), five-year cures in 52 cases (24.1 per cent), and cancer-free cases in 96 instances (44.6 per cent). Tissue removed from the cured cases are classified as follows:

	Cases
Papilloma with atypical cells.....	5
Papillary carcinoma.....	14
Infiltrating carcinoma.....	16
Adenocarcinoma.....	1
Grade I.....	10
Grade II.....	30
Grade III.....	12
Grade IV.....	2
No pathological examination.....	6
Total.....	96

The time periods of cured cases varied from less than one year to more than 20 years.

The author states that the fatal cases die within the first year. The chief cause of death is unquestionably severe infection of the bladder and kidneys. Probably few actually die of carcinoma.

The factors influencing the type of therapy are size of tumor, grade of tumor, position of tumor, and condition of the kidneys. The best surgical five-year results in bladder cancer are 25 per cent. These cases include only those which can be removed surgically. The statistics in the present series of cases include all cases of carcinoma of the bladder seen, regardless of the extent of the lesion. At present, the author is favoring cystoscopic treatment in preference to a suprapubic approach. The various forms of radiation in use are classified as follows: radon seeds, x-ray alone, x-ray plus radon seeds, fulguration, fulguration and x-ray, pre- and post-operative x-ray irradiation, and radium application.

The author states that an infiltrating carcinoma is more difficult to cure than a papillary carcinoma. Bladder carcinomas are more frequently single than multiple.

JOHN G. MENVILLE, M.D.

Intra-uterine Radium Therapy of Hemorrhagic Metropathies. A. Pickhan. *Strahlentherapie*, 63, 682, 1938.

The biologic effect of radium in cases of uterine bleeding may be due to changes produced in the mucosa, the muscles, and the ovaries. By calculation, the author estimates the dose reaching the ovaries during intra-uterine radium application of 1,500 mg.-hr. at approximately 360 r. This cannot be compared with the equivalent dose in x-rays because of the different method of administration. While x-ray therapy takes usually less than one hour, the radium dose is applied over a period of from 20 to 40 hours. The author uses a filter of 0.5 mm. Al only, in order to utilize the beta and soft gamma rays. In his opinion the effect on the bleeding uterus is due to an influence of the rays on the blood vessels in the mucosa as well as on the follicles. Because of careful selection and preparation of the patient, also limitation of the treatment to preclimacteric bleeding, the author has seen no failure of radium therapy.

ERNST A. POHLE, M.D., Ph.D.

Danger of Introducing Radio-active Substances into the Body of Mammals: Experience with Two Mares. T. Nogier. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 362-365, May, 1938.

In June, 1934, a milligram of radium sulphate was given intravenously to two mares weighing 600 kg. The animals remained in good health until 1937, except for a marked leukopenia. In 1937, one animal died and an autopsy revealed a fracture of the pelvis. The bones revealed twice the radio-activity of the blood serum, determined three years previously.

The other mare lived until January, 1938, when a spontaneous fracture of the tibia allowed the mare to fall and choke to death in her halter. The radium content of the bones was four times that of the blood, examined three and one-half years previously.

The dose given was equivalent to 0.1 mg. given to an individual of 60 kg. The author stresses the danger of giving radio-active substances internally, emphasizing the relative potencies of the α and β radiations in intimate contact with the cells.

S. R. BEATTY, M.D.

The Development of Gynecological Radium Therapy, Especially in the Treatment of Non-malignant Disease. C. J. Gauss. *Strahlentherapie*, 63, 561, 1938.

The author, one of the first pioneers in gynecological radiation therapy in Germany, presents a brief sketch of the progress made in the therapeutic use of x-rays and radium in this specialty. His first paper, dealing with the treatment of uterine fibroid by roentgen rays, was presented in 1912. Since then he has been identified with many new developments in this field. Because of the possible danger to future offspring, he advises against temporary sterilization. He emphasizes the usefulness of a combination of x-rays and radium in many conditions.

ERNST A. POHLE, M.D., Ph.D.

THE RECTUM

Melanosis Coli. Louis A. Buie. *Minnesota Med.*, 21, 561-563, August, 1938.

The condition was first described by Cruveilhier a century ago. After its discovery, all studies of the condition were based upon postmortem reports, until the work of Bockus, Willard, and Bauk, which was published in 1933. They found an incidence of 2.7 per cent in the examination of 960 routine "office" patients. Of their patients, 88 per cent were females.

Melanosis coli consists in melanotic deposits in the rectal mucosa. There is rather wide variation in the color of the lesions, but the appearance and arrangement are usually unmistakable, and if the mucosal surface is rubbed with a cotton applicator, inflammatory or ulcerous change, with which the condition may be confused, will not be found. If inflammatory reaction is present, the pinkish stain of serosanguinous exudate will appear on the cotton applicator, when the diseased mucous membrane is traumatized. If there is no such stain, the condition may be melanotic. The pigment

may be light brown, dark brown, or black. It may be scattered in the mucous membrane, or it may leave no part of the lining of the bowel uninvolved; it is rare for the condition to extend beyond the confines of the colon. On closer scrutiny, it will be observed that the coloring is not solid but is divided by linear, yellowish markings, into small segments, usually several millimeters in diameter.

In the author's experience, it occurs almost entirely in constipated individuals. Bartle first called attention to the possible relationship between the constant ingestion of cascara and melanosis coli. The condition may arise as a result of phagocytosis by the mucosal cells.

There is no evidence that the physician should be concerned over the presence of melanotic pigment in the walls of the colon. It has not appeared to have any direct relationship with the development of carcinoma, except as a possible result of the obstructive effect of the carcinoma.

PERCY J. DELANO, M.D.

Rectal Symptoms from the General Surgeon's Standpoint. Harvey B. Stone. *Jour. Am. Med. Assn.*, 109, 1679-1681, Nov. 20, 1937.

The signs and symptoms that accompany rectal disorders may be grouped under comparatively few headings: sensory disturbances, abnormal secretions or discharges, disturbances of defecation, anatomic changes. The duration of any of these derangements and their intensity are also of important bearing in many cases.

Many rectal disorders have a quite characteristic symptom-complex. The difficulty in eliciting a description of it lies in the widespread habit of patients being vague in their complaints and description of rectal disturbances. To obtain a comprehensive history questions pointed on the above headings must be asked. The making of a proper local examination is a necessary requisite to proper diagnosis.

The characteristics of the symptoms are discussed in detail.

CHARLES G. SUTHERLAND, M.D.

SARCOMA

Results of Radiation Therapy in Sarcomas. O. Walther. *Strahlentherapie*, 64, 59, 1939.

This paper, of 53 pages, represents a thorough statistical survey of the 240 sarcoma cases seen at the Roentgen Institute of the University of Zurich from 1919 to 1936. The results are compiled in numerous small, and ten major, tables. There were 132 men and 108 women; the average age was 44.8 years. Solitary giant-cell tumors, lympho-epithelial neoplasms, and melanomas were not included in this survey. The localizations were as follows: Gastro-intestinal tract, 19 per cent; supporting tissue, 16 per cent; skeleton, 14 per cent; respiratory system, 13 per cent; thyroid, 12 per cent; lymph nodes, 9 per

cent; genito-urinary tract, 7 per cent, and breast, 2 per cent. The diagnosis was verified by biopsy in 91 per cent. Among these were round-cell, lymphoid, spindle-cell, and polymorpho-cell sarcoma, some unclassified, also fibrosarcoma, hemangio-endothelioma, Ewing's tumor, endothelial sarcoma, osteogenic sarcoma, myxofibrosarcoma, plasmocytoma, and myeloma.

Thirty-eight, or 16 per cent, were treated by a combination of surgery and radiation and the remaining 202, or 84 per cent, were irradiated. In 28 per cent, radiation therapy was used for palliation only. Of 237 cases observed for one year, 29 per cent were free from symptoms. Of 223 cases observed for three years, 20 per cent are free from symptoms, and of 201 cases observed for at least five years, 13 per cent were well at the time of the study. Thirteen per cent were operable at the time of admission and 87 per cent inoperable. The percentages of cures for the 31 operable cases were 63, 56, and 35 per cent for observation periods of one, three, and five years, respectively. The respective figures for the 209 inoperable cases are 23, 14, and 10 per cent. The best results were obtained in tumors of the orbital and ear region, in the oral cavity, the mesopharynx, the mediastinum, and the supporting tissue. In those, the five-year cures amounted to over 25 per cent. Of the 75 per cent who died from the disease, 62 per cent received palliation. The average period of survival was 12.2 months in this group. Good palliative results were seen in tumors of the paranasal sinuses, the epi- and nasopharynx, and the mediastinum, while poor results were obtained in tumors of the kidney, the colon, and the bladder.

ERNST A. POHLE, M.D., Ph.D.

Voluminous Osteogenic Sarcoma of the Left Coxo-femoral Region. Carteret, Dillenseger, and P. Bertrand. *Jour. radiol. et d'électrol.*, 22, 558, 559, November, 1938.

The patient, a man 45 years of age, complained of pain in the left knee joint and difficulty in walking. However, x-ray examination showed a normal left knee joint. Physical examination showed a tense, fluctuant mass in the region of the left hip and sacro-iliac joints, suggesting an infectious process. The temperature was 38.5° C. (normal 36.8°).

X-ray examination of the left hip joint showed complete disappearance of the head and neck of the femur, with upward and lateral and posterior dislocation of the metaphysis of the femur. The left iliac bone showed very extensive destruction, with marked medial displacement of the acetabulum into the pelvic cavity. Much bone débris was seen in the soft tissues about the hip joint. Some bone production was also noted although it was atypical. A diagnosis of osteogenic sarcoma was made.

Because of the extent of the lesion no active treatment was instituted.

J. SAGEL, M.D.

SCHÜLLER-CHRISTIAN'S DISEASE

Schüller-Christian's Disease M. Esser. *Schweiz. med. Wchnschr.*, 68, 1014-1017, Aug. 27, 1938.

This is the report of a case of Schüller-Christian's disease diagnosed in a child, observed for three years, and practically well at the time of the report. The patient was a female, 14 months of age, who had shown fever, sniffles, and headache for about six months. Enlargement of the spleen and liver, cranial deformity, and typical roentgenologic signs were present. Biopsy (lymph gland puncture and also sternal puncture) showed reticulo-endothelial elements containing many diplococci.

The author concludes, on the basis of this evidence, that the disease is infectious.

LEWIS G. JACOBS, M.D.

Schüller-Christian's Disease. M. Schieber. *Polski Przegl. Radiol.*, 13, 57-77, 1938.

The author presents three cases of Schüller-Christian's disease. He points out that the classical triad of symptoms ("geographical" skull, exophthalmos, and diabetes insipidus) is occasionally missing and the disease may be characterized by only one of these three manifestations. Not infrequently, symptoms of disturbed cholesterol metabolism are observed in other parts of the skeleton and in other organs. The examination of the blood reveals a marked increase of the cholesterol values.

The prognosis of the disease is favorable. Small doses of roentgen therapy may not only improve the condition but even produce a permanent cure, with complete disappearance of the lacuna-like changes in the cranium.

ERNST A. SCHMIDT, M.D.

SILICOSIS

Factors which Determine the Diagnosis of Silicosis. Charles L. Sutherland. *British Jour. Radiol.*, 11, 414-421, June, 1938.

The diagnosis of silicosis depends on three factors: radiologic examination, industrial history, and clinical findings. The radiologic examination is the most important; fluoroscopic examination is valuable, but a good technical film is essential.

The film will show numerous dense, discrete, circular opacities uniformly distributed throughout the lungs. Chronic miliary tuberculosis and carcinomatosis may show the same appearance. The opacities in silicosis are from one-eighth to one-fourth inch in diameter. They may be so dense as to suggest calcification. Owing to the projection on a flat surface, the density may appear greater than it is. Classification of degree of involvement should not be made from the film alone, as it will not give indication of the degree of impairment of pulmonary efficiency. Larger opacities may be formed by the fusion of individual densities. Emphysema is frequent.

The supervention of tuberculosis may modify the appearance. Tuberculosis seems to accelerate the fibrosis.

The diagnosis of tuberculosis may depend upon clinical and laboratory findings. Carcinomatosis may present a difficult problem in differential diagnosis and here the clinical course is important.

The classical type just described is not the most common seen, as many variations occur. The other two factors, industrial history and clinical findings, must be taken into account. Hasty conclusions are to be avoided. The variations in appearance must be differentiated from: simple exaggeration of the normal markings; excessive deposit of dust without fibrosis; nodular fibrosis due to other dusts; congestion, and tuberculosis.

Variations are found particularly in coal miners, where bilateral massive densities are seen. These are thought to be due to the accumulation of dust behind blocked lymphatics.

Asbestosis usually presents greater infiltration at the bases.

SYDNEY J. HAWLEY, M.D.

SKIN DISEASES

Roentgen Therapy in Dermatology. Carlo Guarnini. *Arch. di Radiol.*, 14, 69-102, January-February, 1938.

In a lengthy paper the author discusses his own experience and adds that of authority in the literature in the roentgen therapy of dermatologic affections. The paper is well worth reviewing in the original. One gets the impression that the author "hits a little harder" than most American dermatologists and tends to follow, as is natural, European technics.

E. T. LEDDY, M.D.

Results of Irradiation with Soft Roentgen Rays at a Very Small Focus-skin Distance (Contact Therapy). D. den Hoed. *Acta Radiol.*, 19, 239-249, September, 1938.

Experiments undertaken by the author proved that the relatively soft rays employed in the so-called contact therapy have a similar biological effect to that of harder rays. The depth distribution of radiation was found to be almost identical with that of radium contact therapy.

The results in superficial malignancies of the skin were highly satisfactory. Metastatic skin lesions were also influenced favorably.

The author stresses the limited applicability of this type of therapy which, due to its lack of penetration, is primarily destined to remain a treatment for superficial affections.

ERNST A. SCHMIDT, M.D.

X-ray Treatment of Erysipeloid. Maurice A. Walker and Lewis G. Allen. *Jour. Kansas Med. Soc.*, 39, 383, September, 1938.

Erysipeloid is described as an entity in dermatological text-books. Following a break in the skin while handling fish, typical local inflammatory changes occur with-

out constitutional symptoms. The authors report a case which was treated by roentgen therapy with good results. The dose consisted of 150 r generated at 90 kv. and filtered through 1 mm. of aluminum. This was repeated every third day for a total of four doses. The patient improved rapidly and was able to return to work four days after the last roentgen treatment.

L. W. PAUL, M.D.

THE SPINE

Compression of a Vertebra by a Hemangioma which was Clinically Cured by Radiotherapy. G. de Luca. *Arch. di Radiol.*, 14, 271-278, 1938.

A case of probable hemangioma of the eleventh dorsal vertebra received a course of protracted fractional x-ray treatments through two dorsal oblique fields with a total dose of 2,000 r per field (200 r a day) with resultant marked improvement. Repetition of treatment gave an apparent cure. The author feels that his case is a valid one even though the roentgenograms were not "characteristic."

E. T. LEDDY, M.D.

A Case of Vertebral Disease, Difficult to Diagnose, in Retrospect. C. Roederer and Choffat. *Bull. et mém. Soc. Radiol. Méd. de France*, 26, 13, 14, January, 1938.

A boy 14 years of age had, from the age of three, shown a round back, apparently of the juvenile type. Roentgenograms demonstrated changes in the lower dorsal spine which, the authors believe, may be due to a "dry" type of Pott's disease.

S. R. BEATTY, M.D.

The Roentgen Diagnosis of Tuberculous Spondylitis. Nils Westermarck and Gösta Forssman. *Acta Radiol.*, 19, 207-214, September, 1938.

Tuberculous spondylitis can be divided, roentgenologically, into a focal osteitis and a diffuse osteitis. While the focal osteitis type is more frequent in adults, diffuse osteitis is more prevalent in childhood.

Focal spondylitis may be sub-divided into two different types. One type presents definite osteosclerosis and periosteal deposits during its initial stages while the other type is characterized by rounded or irregular sequestration and a rarefied border zone. Both types of focal spondylitis are most frequently seen in the anterior lateral border of the vertebral body. The radiographic detection of focal spondylitis is possible at a relatively early stage of the disease. On the other hand, diffuse tuberculous spondylitis is, as a rule, discovered at a comparatively late stage.

ERNST A. SCHMIDT, M.D.

Radiation Therapy of Primary Hemangioma of the Vertebrae. Ira H. Lockwood and Charles E. Bell. *South. Med. Jour.*, 31, 827-834, August, 1938.

In 1927, Schmorl's Institute reported that heman-

giomas were found in 10 per cent of all spines examined there. Most often they existed in the thoracic and lumbar areas. When symptoms are present, the clinical picture is of low back or leg pain with remissions and relapses or spastic paraplegia. The radiographic appearance is characteristic, with dense vertical trabeculae in the body of the vertebra, separated by areas of irregular bony trabeculae, giving the bone a striated appearance.

Radiation is the treatment of choice, producing symptomatic relief, but no change in the architectural appearance of the vertebrae. In three cases reported, the authors, using 200 kv. and heavy filtration, applied daily, or at short intervals, 200 r units for a total of from 1,800 to 2,550 roentgens, in two instances giving additional irradiation one month later. Excellent results were obtained.

JOHN M. MILES, M.D.

A Case of Echinococcus of the Spine Difficult to Interpret Roentgenologically. Carlo Guidotti. *Arch. di Radiol.*, 14, 304-308, 1938.

In this case no definite diagnostic data could be obtained except those specifically for echinococcus, which were positive. Operation proved the diagnosis and cured the patient.

E. T. LEDDY, M.D.

Changes in the Vertebral Column Following Tetanus. E. Feistmann-Lutterbeck. *Acta Radiol.*, 19, 391-398, October, 1938.

The author subjected the spines of 14 patients, who had suffered from tetanus, to roentgenological examination. In only one case, that of an eight-year-old boy, pathologic changes attributable to tetanus were determined. These findings, which were seen two and one-half years after tetanus, consisted in flattening of the body of the seventh thoracic vertebra; the adjoining disks showed little change. Pathologic changes in a second case were probably due to a preceding spondylitis. In the remaining 12 patients, the findings were either normal or inconclusive.

ERNST A. SCHMIDT, M.D.

SYPHILIS

Gastric Syphilis, Pseudo-neoplastic Type: Clinical and Radiologic Study. H. Marc and Sire. *Arch. d. mal. de l'app. digestif*, 28, 813-819, October, 1938.

After a year of gastric distress characterized by constant pain, digestive disorder, and weight loss, the patient, a woman 47 years of age, was examined by the authors following an abundant hematemeses.

The examination showed massive infiltration of the walls of the stomach, more marked on the greater curvature, with several irregular defects. There was no peristalsis, the stomach was rigid, and to palpation the stomach, antrum, and bulb appeared fixed, as though by perivisceritis. A diagnosis of massive neoplastic infiltration was made.

After another two and one-half years of constant distress, the general state of the patient was so good as to be incompatible with gastric carcinoma and the patient was placed on anti-syphilitic therapy (Bordet Wassermann 2+). After one and one-half months of treatment, there was marked clinical improvement.

In retrospect, there were several reasons to make a diagnosis of carcinoma questionable. The intense, persistent pain, the abundant hemorrhage, the absence of metastasis or cachexia, and the multiplicity of lesions, rare in carcinoma but frequent in syphilis, should have been given more consideration in the diagnosis.

S. R. BEATTY, M.D.

Two Cases of Gastric Syphilis. P. A. Blinkenberg. *Acta Radiol.*, 19, 480-486, November, 1938.

The relative rarity of gastric syphilis is demonstrated by the fact that during the last 15 years only seven cases were reported from the Scandinavian countries. The author adds two cases from Denmark, thus bringing the total up to nine cases.

One of these cases was seen in a 28-year-old woman whose complaints were pain in the region of the cardia and occasional vomiting. The roentgen examination showed a large filling defect in the pyloric canal, but no six-hour gastric residue. Ulcer régime and anti-syphilitic treatment failed to relieve the patient's symptoms, and a gastro-enterostomy was performed. In the pyloric canal a large infiltration resembling a tumor was found but the histologic examination showed simple inflammation. A later x-ray examination showed that the filling defect persisted, although the Wassermann reaction had become negative following specific therapy.

The other case was observed in a 44-year-old woman whose complaints consisted in nausea, vomiting, and considerable loss of weight. Physical examination revealed a tumor of the size of a child's head in the right iliac fossa which upon exploration proved to be an ovarian cyst. A questionable resistance was felt in the epigastrium. The x-ray examination showed complete pylorostenosis, and cancer in the pyloric canal was considered. The ensuing operation failed to reveal any tumor. There was marked swelling of the stomach wall in the region of the canalis egestorius. The serologic findings were reported as: Wassermann positive; Kahn positive.

In both cases the discrepancy between roentgenological findings and subjective symptoms was evident.

ERNST A. SCHMIDT, M.D.

Syphilis of the Bones and Joints. Frederick A. Jostes and Maurice B. Roche. *Jour. Missouri Med. Assn.*, 36, 61-68, February, 1939.

The authors present a survey of 111 clinically active bone and joint lesions resulting from syphilitic infection. Pertinent information from the case histories is presented in tabular form. In the group with congenital syphilis, periostitis, osteitis, osteochondritis,

Sutherland reviews the history and development of the roentgen ray in its application to medicine.

The diagnosis of bone tumors is dealt with exhaustively. As a working classification he gives: (1) Benign osteogenic tumors; (2) periosteal fibrosarcoma; (3) non-inflammatory lesions simulating benign conditions of bone; (4) giant-cell tumor; (5) benign angioma; (6) myeloma; (7) malignant osteogenic tumors; (8) inflammatory conditions simulating malignant lesions of bone; (9) Ewing's tumor, (10) malignant angioma, and (11) metastatic involvement.

The outstanding feature of a benign tumor of bone is retention of cortical contour. The cortex may be expanded or deformed but there is no solution of its continuity. On the other hand, the almost pathognomonic characteristic of the malignant osteogenic tumor is the definite break in the continuity of the cortical outline. Benign tumors occur, for the most part, about the age of puberty, or at least, early in life. This fact points to a disturbance in development of the cartilaginous elements in the formation of bones and joints.

Exostoses occur in two forms: the cauliflower excrescence of cartilage and the multiple symmetrically distributed lesions of the same type which are familiar to most roentgenologists as hereditary deforming chondrodysplasia.

Benign hemangioma occurs near the metaphysis of long bones. It expands the cortex but does not extend deeply into the medullary or cancellous spaces. The roentgenographic image is that of a "soap-bubble" and is somewhat similar to a giant-cell tumor. Simple cyst, osteodystrophia fibrosa, and giant-cell tumor would seem to fall into the same category, as to basic origin.

In the spinal column complete destruction of one or more vertebral bodies is suggestive of myeloma.

Sarcoma is divisible into several groups: (1) Subperiosteal and medullary sarcoma; (2) periosteal sarcoma; (3) sclerosing sarcoma; (4) telangiectatic sarcoma; (5) chondrosarcoma, and the sarcomas involving the diaphysis.

Careful technic is often required to demonstrate a subperiosteal or medullary sarcoma. More than one projection may be required to demonstrate the break in periosteum.

Sclerosing sarcoma shows an intense eburnation of the involved portion of bone. Particularly in the upper end of the tibia the tumor may be difficult to distinguish from syphilitic osteitis.

Ewing's tumor tends to involve the mid-diaphyseal portion of the shaft of long bones; it rarely affects persons more than 21 years of age.

Metastases may be osteoclastic or osteoplastic: the former type is most typically seen in the tumors of the breast. In the spine, it may be confined to a single vertebra as a destructive process. At necropsy, vertebrae have been found so softened that one could force a finger into them, yet the detection of the lesions roentgenologically called for the closest scrutiny. Small lesions may occur in the ribs.

Osteoplastic metastases are almost always secondary

to carcinoma of the prostate. The first condition to be differentiated here is Paget's disease. In Paget's disease, the evidence of trabecular bony outline is always maintained or exaggerated; in carcinomatous metastases it is always obliterated.

Roentgenologic study is one of the best ways of arriving at the diagnosis of bone tumors; biopsy is required when surgical intervention is contemplated.

PERCY J. DELANO, M.D.

True Fibroma of the Stomach. C. Bonorino Udaondo, E. Finochietto, and D. Mosto. *Arch. d. mal. de l'app. digestif*, 28, 590-607, June, 1938.

The authors present a new case of fibroma of the stomach. Roentgenologically, this appeared as a deformity of the antrum which appeared tubular and shrunken, with an irregular defect on the greater curvature. The operative specimen showed a superficially ulcerated fibroma of the submucosa about 6 × 3.5 cm. Exhaustive histologic studies proved the tumor to be a true fibroma.

The symptomatology, diagnosis, and histopathology of fibroma of the stomach are discussed. The authors have reviewed the literature, with especial reference to the frequency of occurrence of benign tumors of the stomach.

S. R. BEATTY, M.D.

Bony Intracranial Tumors. Cobb Pilcher. *South. Med. Jour.*, 31, 613-619, June, 1938.

Three unusual types of intracranial bony tumors, which were removed successfully, are reported.

The first is a case of an osteoma of the frontal sinus in a 20-year-old white male in whom the tumor extended into the orbit and cranial chamber. First noted was a slight hard prominence of the left forehead, increasing in size and followed three years later by swelling, exophthalmos, and pain behind the eye on the affected side. A multinodular tumor, measuring 8 × 6 × 5 cm., was removed at operation.

The second was an osteoma of the inner table of the temporal bone in a white female 41 years of age. Clinical symptoms and x-ray evidence were present for ten years before operation revealed a large nodular bony mass which had protruded through the dura and forced the temporal lobe of the brain upward. The symptoms were intermittent, unilateral headache, tinnitus, nocturnal convulsions, and occasional "dreamy state" attacks.

Case 3 was the report of a bilateral intradural bony growth in a white female 39 years of age. The symptoms were neurotic or mildly psychotic in nature, with severe and frequent headaches, and periodic elevations of blood pressure to 250 mm. systolic. The relation of trauma to the condition was obscure. At operation, a flat plaque of bone, 4 cm. wide and 15 cm. long, was found adherent to the dura and extending from the superior sagittal sinus overlying the cortex of the brain.

to which it was lightly adherent in the right frontal and parietal regions. Small peripheral plaques were present and a small amount of similar bone was felt through the dura on the opposite side.

JOHN M. MILES, M.D.

The X-ray Aspect of Perisellar Tumors. Teofil Blühbaum and Marcell Spritzer. *Polski Przegl. Radiol.*, 13, 7-46, 1938.

The intracranial tumors may be classified as intrasellar, metasellar, and perisellar. This classification is based not only on radiologic-topographic reasons, but also on clinical-methodological considerations.

The x-ray diagnosis of the intrasellar tumors presents, as a rule, no unusual difficulties and is frequently possible after a single roentgenographic examination.

For the diagnosis of the metasellar tumors, the application of auxiliary radiographic methods (encephalography, ventriculography, or arteriography) is necessary.

The radiological diagnosis of perisellar tumors depends on special refinements of the available technical methods.

The authors discuss the anatomical conditions and the diverse projections of the sella turcica. The limitations of the radiological diagnosis and the general value of the different tumor signs and clinical symptoms are outlined in detail.

The observations and conclusions of the authors are based on 273 clinically diagnosed cases of intracranial tumors, of which about 50 per cent were confirmed by radiological examination and about 10 per cent verified by operation or autopsy.

A number of illustrative sketches and roentgenograms accompanies the article.

ERNST A. SCHMIDT, M.D.

TUMORS (THERAPY)

The Radiosensitivity of Ewing's Tumor. Georges-Claude Leclerc. *Jour. radiol. et d'électrol.*, 22, 550, 551, November, 1938.

This is a report of 14 cases of Ewing's tumor, all except two of which were treated with x-ray. The other two were treated with radium and, therefore, are not included in this report.

The disappearance of Ewing's tumor under x-ray treatment is so rapid and so frequent that it can be used as a therapeutic test, although the response is not absolutely constant. One of the author's cases was not influenced by x-ray treatment, although this was an advanced case which had been curetted and drained as osteomyelitis. The first symptoms that are influenced are pain and fever, followed by improvement in the general condition. Then the local inflammatory signs and the tumor mass begin to disappear—this followed by gradual disappearance of the tumor, as seen on the x-ray films, with re-ossification and the return to apparently normal bone.

As to the ultimate results of treatment, one case (mentioned above) was not benefited. Of the other 11,

the result of one case is unknown. One patient had a local cure but died of paraplegia soon after the beginning of treatment. One case has had no recurrence for ten years. All of the others have had recurrences which appeared from six to eight months after x-ray treatment was instituted, except for one which recurred two years later. The recurrence usually had the same x-ray appearance as the primary lesion.

Most writers report that the recurrences are radiosensitive like metastases, but five of the author's eight patients who were retreated showed no benefit. Of 18 cases, only three have survived: one by surgery alone, one by irradiation alone, and one by the combined treatment. In this series, the best treatment would seem to be a combination of surgery plus irradiation.

J. SAGEL, M.D.

Giant-cell Tumor ("Osteoclastoma") of the Femur Treated with X-rays. S. Dechambre, E. Dechambre, and J. Nebout. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 379, 380, May, 1938.

A tumor of the upper half of the left femur of a nine-year-old girl, diagnosed radiographically as a giant-cell tumor, was treated with x-rays. There was considerable soft-tissue swelling, with pain and loss of function. In 26 days, 13 treatments were given anteriorly and 13 posteriorly to the upper half of the thigh; 250 r to a single field of 225 sq. cm. was given daily (200 kv., 3 ma., 40 cm. F.S.D., 1 mm. Cu + 2 mm. Al + 1 cm. wood). During this treatment a fracture occurred, accompanying a considerable decrease in calcification of the bone. Clinical improvement occurred after two months. Films two years later demonstrated considerable recalcification of the bone with some deformity due to the fracture. Pain and swelling had not recurred.

S. R. BEATTY, M.D.

The Treatment of Malignant Granulomas by Radiotherapy. René Gilbert. *Jour. de radiol. et d'électrol.*, 22, 577-585, December, 1938.

X-ray therapy is the treatment of choice for malignant granulomas, and it usually produces remissions of considerable duration. Many cases are submitted for a therapeutic test of x-radiation. Treatment cannot be systematized and must be adapted to the individual case. The author emphasizes the anatomical and clinical characteristics of the disease.

X-rays produce a direct destructive effect on the granulomatous tissue which is followed by fibrous tissue formation. Local recurrences are usually due to insufficient dosage and to radioresistant types. Histologic study is no sure indication of radiosensitivity but indicates whether the specimen is fibrous or cellular. However, at times even the cellular form appears resistant at the beginning of treatment. The author feels that acquired resistance is due to short-spaced and often repeated doses of x-rays and confirmed this by experimentation on the seminal epithelium of the

rat. He advocates heavy doses at first, as with malignant tumors, with no radiation in the absence of recurrence to avoid or lessen acquired radioresistance. There is no difference in the biologic action of x-rays and radium.

Teleroentgen therapy has proved ineffective and dangerous and has been abandoned by most men, including Teschendorf, its originator, so that to-day the segmental (localized) therapy is the treatment of choice. As to posology, there are three factors: (1) The method of fractionation of the dose in relation to the time; (2) the total dose received by the diseased tissues, if they are deep, and (3) the total volume of irradiated tissues in relation to the exposed surfaces. The incidental dose per treatment is generally 250 r, an effective dose to the skin (180 r measured in air for a field of 150 square cm.), at the rate of from 10 to 20 r per minute. The total minimal depth dose is 500 r for a very radiosensitive lesion, given at the beginning of treatment. This will be increased for the less radiosensitive lesions, taking into consideration the condition of the patient, the blood picture, and the tolerance of the irradiated tissue. This will be followed by a complementary series in from six to eight weeks in the case of a large tumor which does not regress sufficiently. The total period of treatment is usually five weeks, with from 10 to 15 days per field. Prophylactic radiation, in the absence of recurrence, should not be given; but periodic examination should be made to discover and treat recurrences early. Statistics of the last 15 years, compared to those which preceded deep x-ray therapy, bear witness to the progress.

As to the age factor, the most favorable cases are in the third and fourth decades, and after the age of 40 years the disease assumes a more malignant character. Life has been prolonged in the more favorable cases. The effect of a remission produced by x-ray therapy is actually a clinical cure, with the ability to work and lead a fairly normal existence. Uneventful pregnancy occurred in a small number of cases during periods of remission.

The author presents his results in table form and also the reported results from the literature.

J. SAGEL, M.D.

THE UTERUS

The Development of Treatment Methods for Uterine Carcinoma at the Women's Clinic of the University of Würzburg. T. C. Neef. *Strahlentherapie*, 63, 569, 1938.

The author, who is the physicist of the Radiation Institute attached to the Women's Clinic of the University of Würzburg, outlines the methods used there in the treatment of uterine cancer. Depth doses for various qualities of roentgen rays, tables showing maximum doses for radium screens, and tolerance doses for intestines, bladder, and vagina are given. The technic of the combined x-ray and radium treatment is outlined in detail, including single and total doses in r for both. With proper distribution, the vaginal mucosa

may tolerate as high a total dose as 20,000 r. The value of radiation therapy in inoperable cases is emphasized.

ERNST A. POHLE, M.D., Ph.D.

Involution of the Uterine Cavity after Irradiation of Fibromas. Guilbert, Tortat, Frain, and Le Guern. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 395-401, June, 1938.

The authors have made a practice of doing an hysterography on each case of uterine fibroids presented for radiotherapy, as a complementary method of diagnosis, and recently have added a second such study, six months after radiotherapy. Measurements of the shadow of the uterine cavity have demonstrated a reduction in size in only those cases in which the treatment succeeded in reducing the size of the fibroma.

S. R. BEATTY, M.D.

Carcinoma of the Uterine Cervix. Harry H. Bowing and Robert E. Fricke. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 47-52, July, 1938.

This review is of patients treated from 1915 to 1929, inclusive. All types were treated, from the early to the far advanced. It is felt that the intensive broken-dose method of radium therapy, followed by roentgen treatment, after thorough study and planning of each individual case, offers the best results.

Although the great majority of the patients treated were in an advanced stage, of the entire number 26.8 per cent lived five or more years. Of those with lesions in Stage 1, 69.2 per cent were well at the end of five years, and 60.2 per cent of those with borderline lesions. The risk is very slight, as there was only 1 per cent hospital mortality rate and that only in the advanced cases.

S. M. ATKINS, M.D.

Results and Experiences in the Treatment of Carcinoma of the Cervix, with Special Consideration of Radium Therapy. P. Caffier. *Strahlentherapie*, 63, 639, 1938.

In the Women's Clinic at the University of Berlin, an "elective" therapy of carcinoma of the cervix is practised and advocated. All operable cases in good general condition are operated on and the remaining patients are irradiated. The author's report is based on 1,314 patients seen and treated in the period from 1926 to 1932. The absolute percentage of cure was 28.9 per cent and the relative percentage of cure of 399 cases operated on, 45.9 per cent. The respective figure for irradiated cases amounted to 21.9 per cent in 905 cases. Comparing the irradiated Groups I and II with the cases operated on, it appeared that only 35.8 per cent were cured by irradiation, a figure which is definitely lower than the one for the cases operated on. This observation strengthens his advocacy of operation in suitable cases. Very striking were the good results obtained by radiation therapy in advanced stages of the disease; even in this group the five-year percentage amounted to 13.2. The mortality of intra-uterine

radium application was 1.5 per cent; only three definite cases of ulcerative proctitis were observed in this series.

ERNST A. POHLE, M.D., Ph.D.

Treatment of Myoma Uteri. Thomas B. Lee. Jour. Med. Soc. New Jersey, 35, 590-594, October, 1938.

An analysis of 500 cases of uterine fibromyoma, seen on the gynecological service of the Cooper Hospital, in Camden, has convinced the author that radiation therapy is of limited usefulness. A total of 385 cases were treated surgically. No estimates of the irradiated cases are given.

The contra-indications to radiation therapy are outlined and a preference for radium is indicated. In 54 cases thus treated, a diagnostic dilatation and curettage were first performed, followed by the insertion of 100 mg. in the uterine canal for 24 hours, and screened by from 1.5 to 2 mm. of platinum or its equivalent. About a year is required for complete regression. A rapid sedimentation rate, leukocytosis, and pain are regarded as positive contra-indications to the use of radium. X-ray therapy is reserved only for inoperable cases, or cases in which the tumor is too large for radium (size of a three-months pregnancy).

MAX MASS, M.D.

Pretended Responsibility of Roentgen Therapy for Sarcomatous Degeneration of Irradiated Fibroids. Gaston Daniel. Bull. et mém. Soc. de radiol. méd. de France, 26, 345-350, May, 1938.

There is no real foundation for the belief held by some, that irradiation therapy of fibroid tumors of the uterus initiates sarcomatous degeneration of these tumors. Several studies of large series of cases have shown conclusively that there is really a lower incidence of sarcomas in uteri previously irradiated than in those never treated by irradiation.

The author believes sufficient evidence exists to allow him to recommend adequate irradiation with roentgen rays and radium as the method of choice in treatment of sarcoma of the uterus, with hysterectomy to follow in certain cases.

He calls attention to the "sign of paradoxical radio-sensitivity" as a diagnostic point. A supposed fibroma, which is rapidly reduced in size following irradiation only to recur soon after cessation of treatment, is almost certainly a sarcoma.

S. R. BEATTY, M.D.

The Present Method of Radiation Therapy of Uterine Carcinoma in the First Gynecological Clinic of the University of Munich. F. G. Dietel. Strahlentherapie, 63, 614, 1938.

The author prefers the single radium application in carcinoma of the cervix rather than treatment in several series at intervals of several weeks. More weight is placed on radium therapy, although the great value of roentgen irradiation as a supplementary treatment is admitted. The technic for both x-ray and radium is described in detail. By very carefully controlled irradiation the percentage of radiation injuries could be definitely reduced. While the number of ulcerations seen during the period from 1935 to 1937 amounted to 3.73 per cent, and fistula to 0.31 per cent, the figures for the following year were only 1.26 and 0 per cent, respectively. Using a combined radium and x-ray irradiation in 64 patients with carcinoma of the fundus, freedom from recurrence for a period of from one to four years was observed in 75 per cent of all treated cases. Because of the lack of five-year data, no definite conclusions are drawn as to the comparative value of operation and irradiation. The author emphasizes the importance of good general care, especially as to diet and medication (tonics).

ERNST A. POHLE, M.D., Ph.D.



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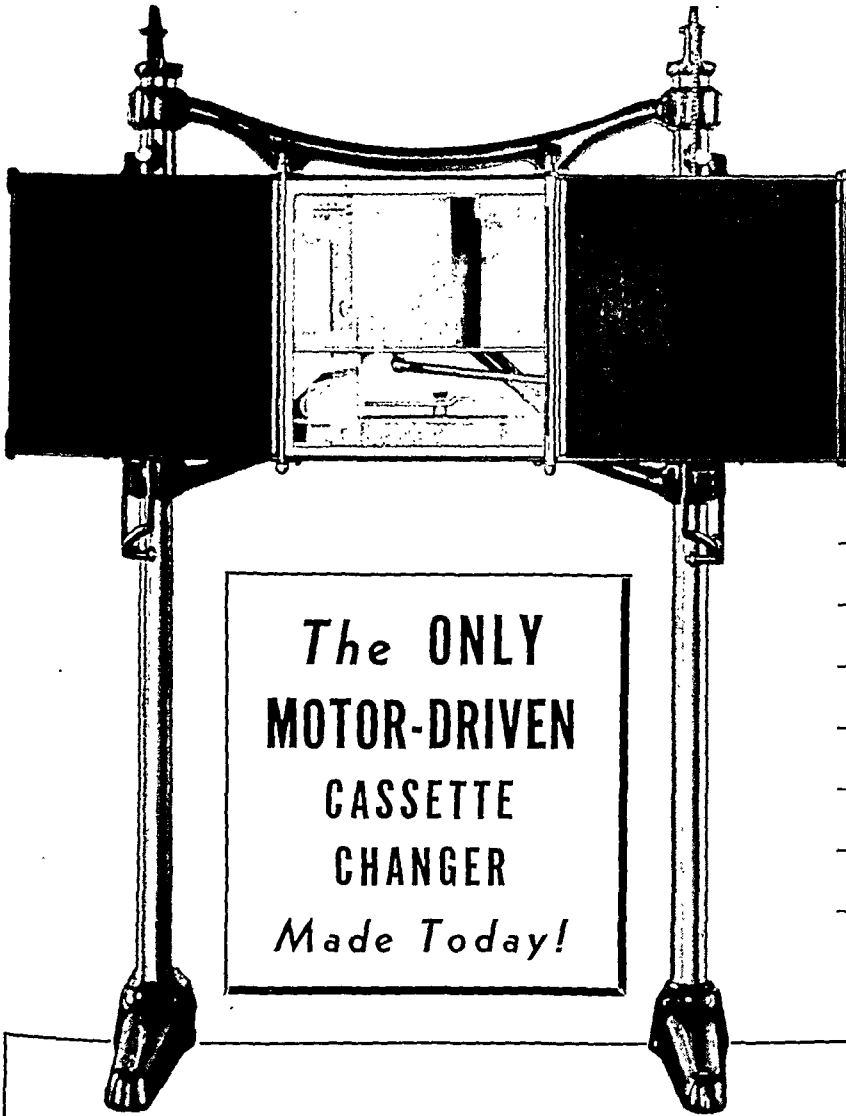
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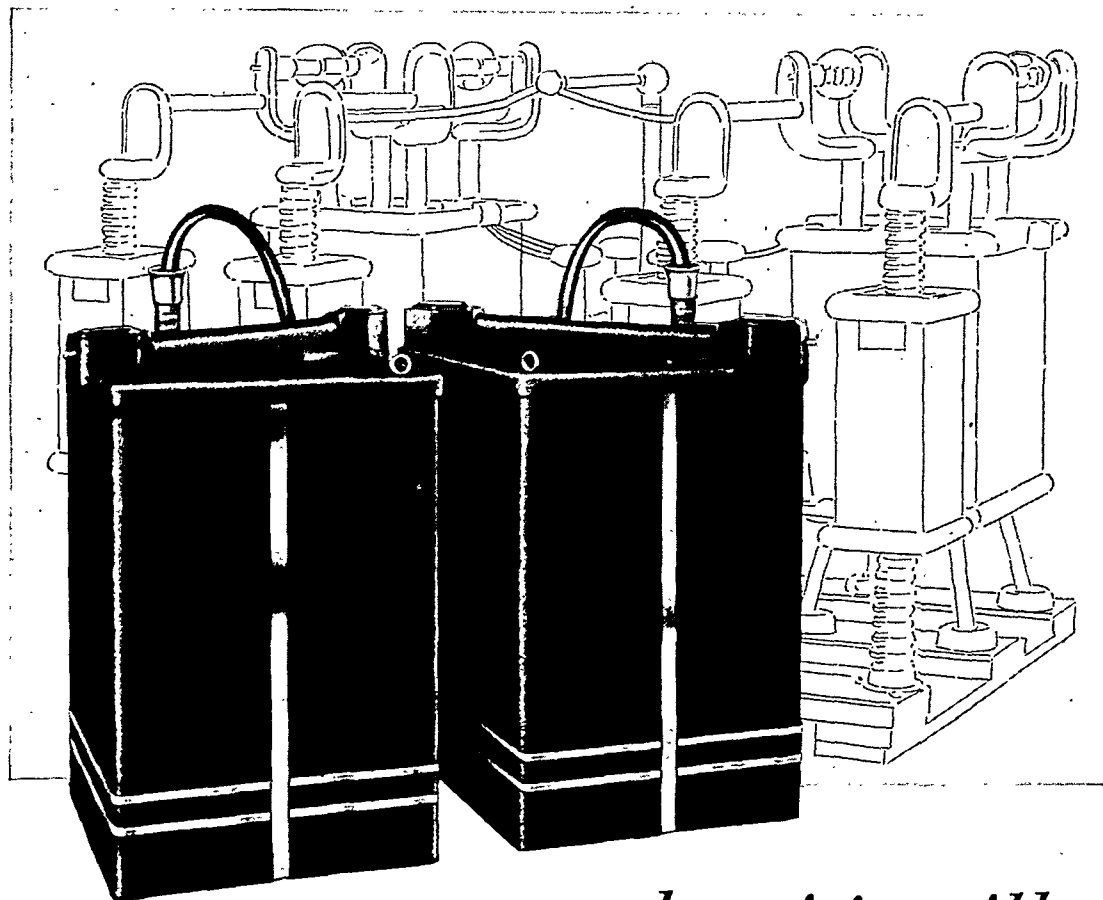
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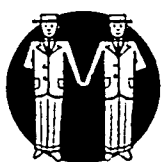
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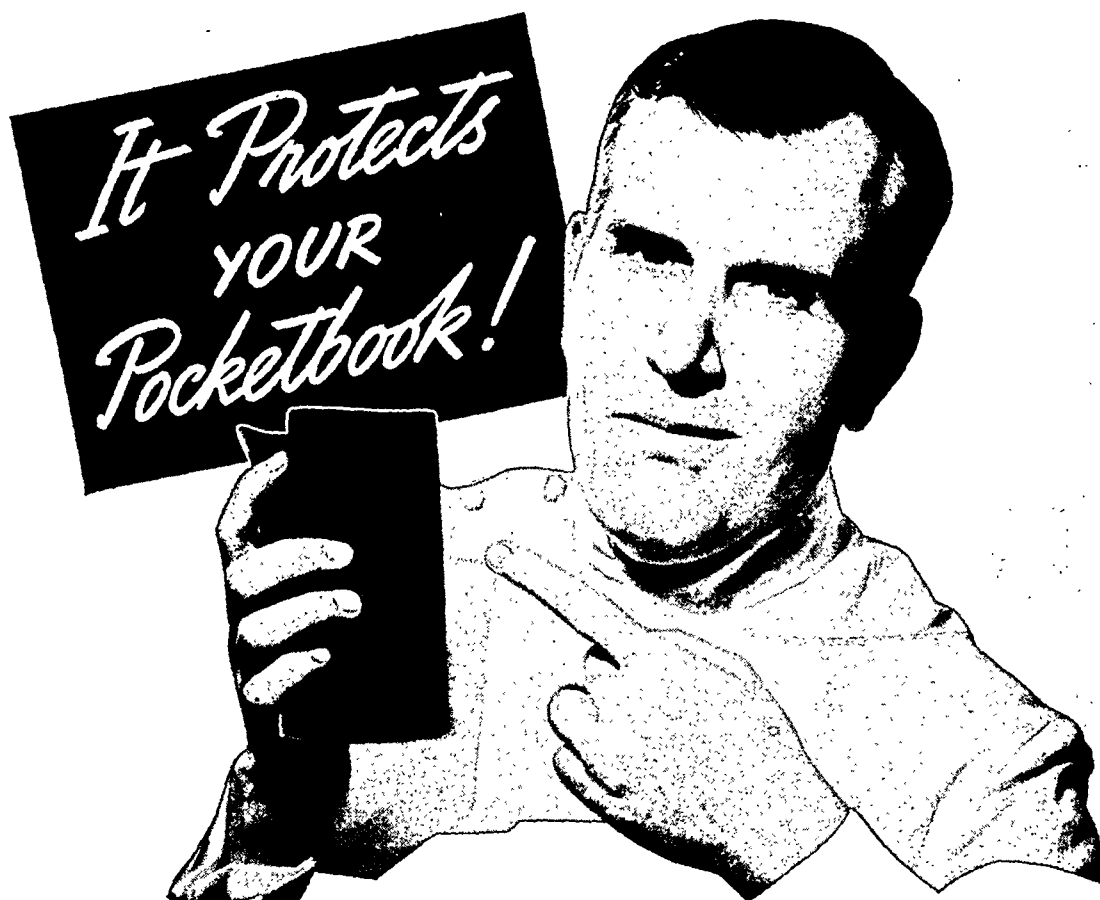
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500	9.47	13.94	20.02	23.27	31.91	36.68	42.05	46.00	13.07
600	10.74	15.58	22.16	25.67	35.43	40.60	46.38	50.72	13.89
700	12.01	17.28	24.31	28.08	38.95	44.52	50.70	55.44	15.82
800	13.28	18.95	26.45	30.49	42.47	48.43	55.02	60.16	17.74
900	14.55	20.62	28.60	32.98	45.99	52.35	59.34	64.88	19.67
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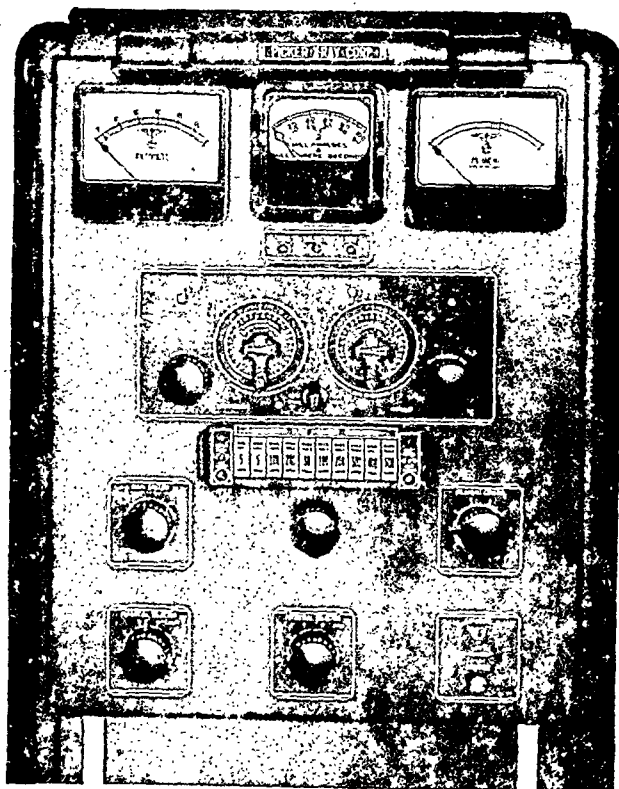
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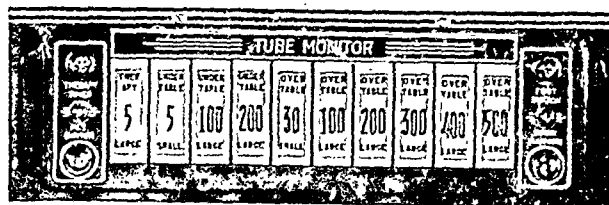
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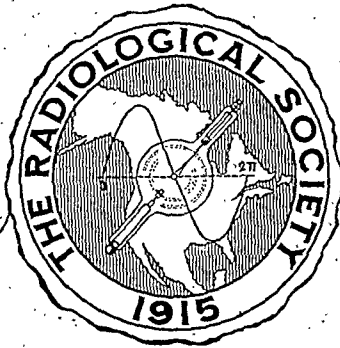
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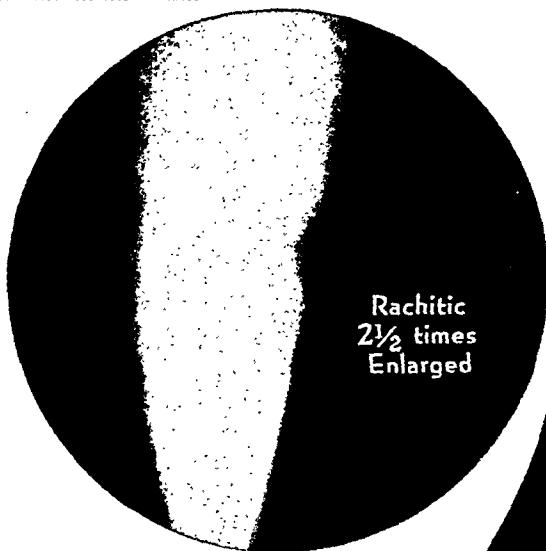
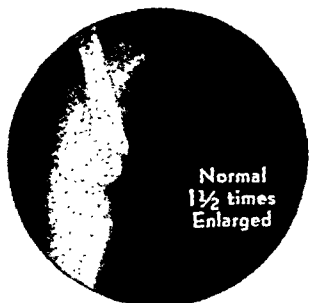
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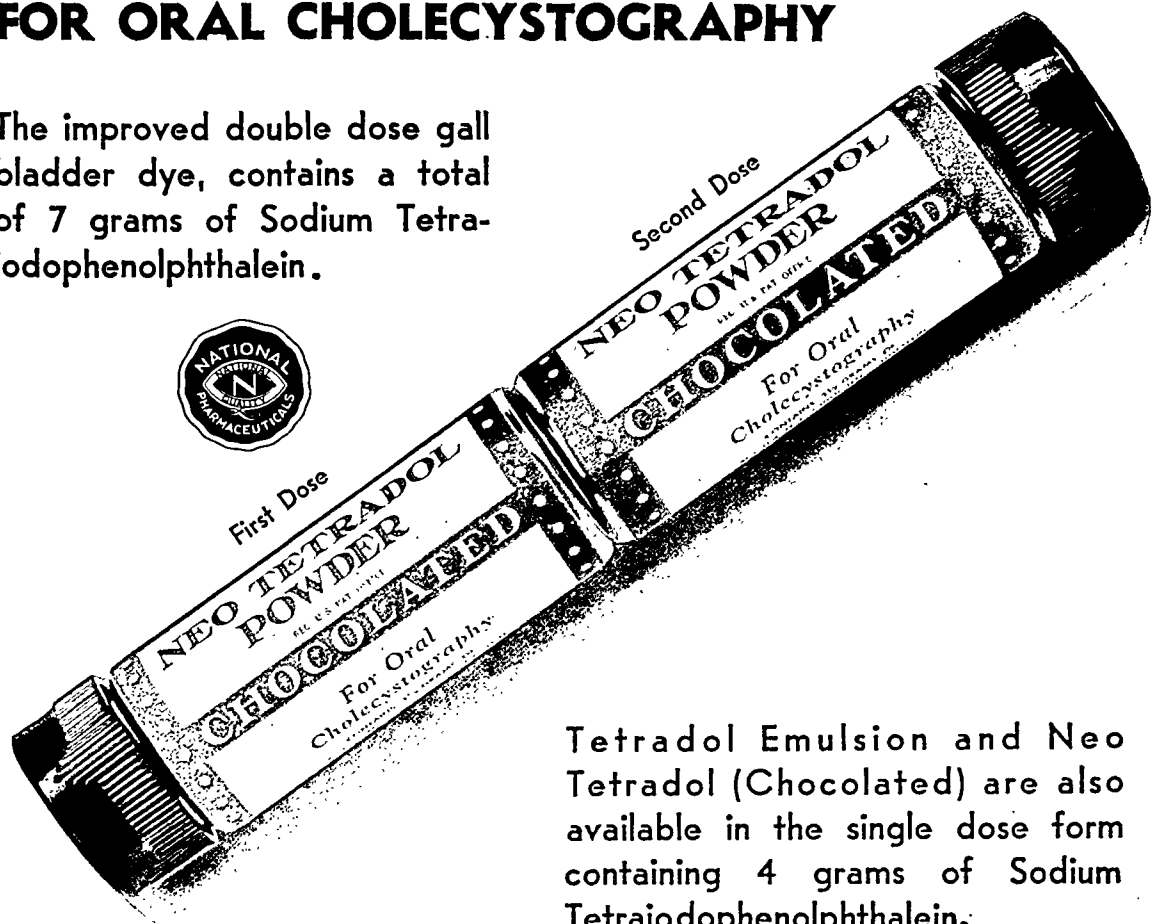
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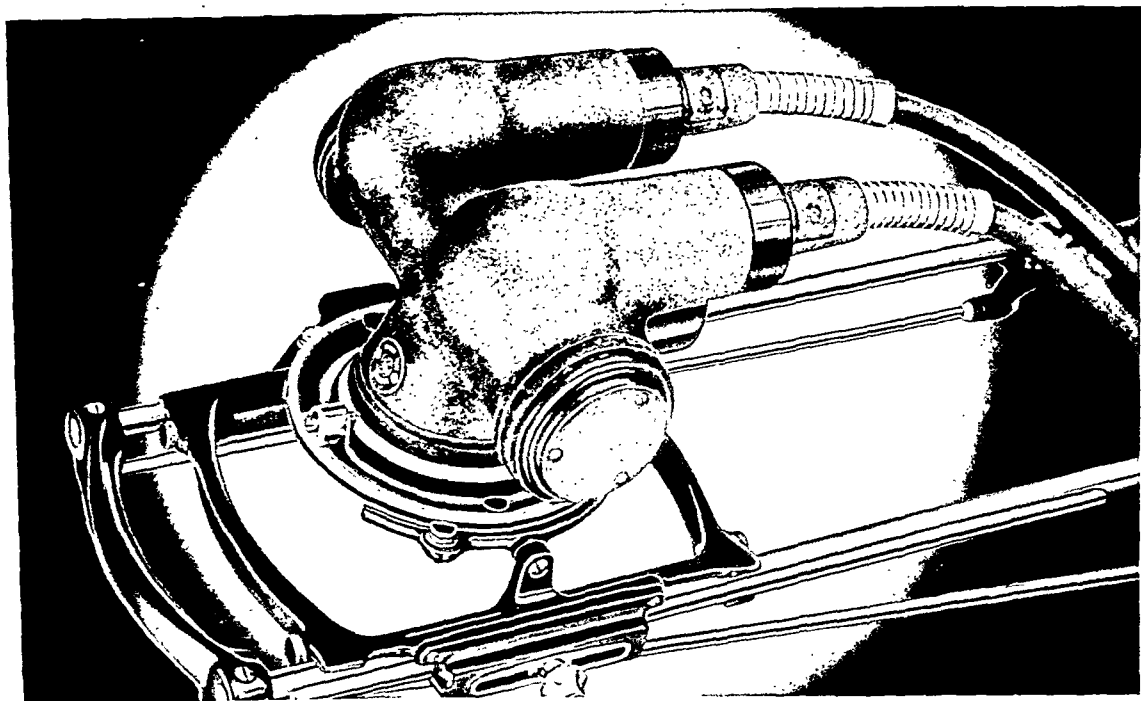
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No. 6

CARCINOMA OF THE THYMUS, WITH MARKED PULMONARY OSTEO-ARTHROPATHY

By EARL R. MILLER, M.D., *San Francisco*

From the Department of Pathology, Stanford University School of Medicine

INTRODUCTION

THE literature concerning neoplasms of the thymus was reviewed, in 1932, by Crosby (8) who gave 103 references dealing with thymic tumors, among which were 122 cases of sarcoma and 36 cases of carcinoma. In the 30 papers dealing with the subject since that time, 44 cases have been recorded. The largest single series was that of Symmers (17) who reported 25 cases out of 17,000 autopsies at Bellevue Hospital, New York, the incidence being 0.14 per cent.

Of the 78 cases of sarcomas in Crosby's group, there were 45 males, 24 females, and 9 in which the sex was not stated. Forty-four cases of sarcoma had previously been reported by Rubaschow (14). The oldest was 86 years of age, and the youngest four and one-half. Of the carcinomas, there were 25 males, 10 females, and one in which the sex was not stated. The oldest was 72 years of age and one was reported at birth. Sarcomas usually occur before 40 years of age and carcinomas after 40. The sarcomas infiltrate the neighboring organs and tend to metastasize widely, usually *via* the blood stream. Carcinoma prefers the lymph channels for its extension, tends to infiltrate the surrounding structures more widely, and has a much higher incidence of central nervous system metastasis than sarcoma. Tables giving

the incidence of metastasis in various organs are found in Crosby's article.

Classification of Thymic Tumors.—Symmers (17) recognized five types of tumors: perithelioma, lymphosarcoma, epithelioma from epithelial reticulum cells, spindle-cell sarcoma, and Hodgkin's tumor. Ewing's (10) classification is widely quoted: lymphosarcoma or thymoma, carcinoma arising from reticulum cells, and the rare spindle-cell or myxosarcoma. Andrus and Foot (5) divide the malignant thymomas into seven types: thymocytic or lymphatoid, large-celled or lymphoblastic, thymic reticulum-cell type, perithelial, granulomatous (Hodgkin's), epithelial or carcinomatous, and teratoid.

Since histologists do not agree on the origin of the reticulum and round cells of the thymus, the classification of its tumors is unsatisfactory. However, there are some tumors that are obviously carcinomas because of their squamous or glandular structures and others are easily identified as sarcomas. There remains a group about which there is much discussion.

Nomenclature.—The term "thymoma" is used, unfortunately, to mean different things by different authors, and even to mean different things by the same author, within a few paragraphs. It may mean any tumor of the thymus or only the round-

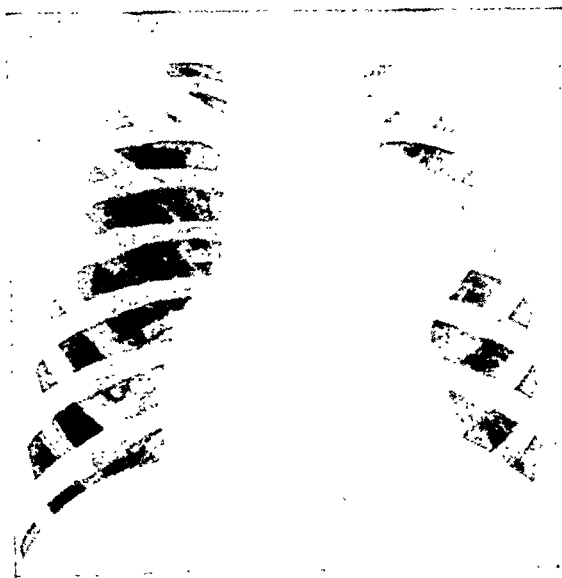


Fig. 1. Film of chest when patient was first seen. This appearance remained essentially unchanged after heavy irradiation.

celled tumors supposedly derived from thymocytes. The latter cells are of unknown origin; to some they are identical with lymphocytes, in which case the thymoma and the lymphosarcoma are identical, and to others they are distinct.

The diagnosis of reticulum-cell sarcoma also seems somewhat unsatisfactory since the histological and radiological criteria on which it is made are ambiguous. To one text-book author (Smith and Gault, 16) it means a radiosensitive tumor and to another (Boyd, 6) it means a radioresistant one. Some authorities say, for instance, that if a supposed lymphosarcoma does not melt away under moderate roentgen irradiation it belongs to the reticulum-cell sarcoma group. To one author it means simply a large-celled lymphosarcoma, to another it means a tumor in which the reticulum blends with the cytoplasm of the cells, and to others it is synonymous with carcinoma. Published illustrations of very different appearing tumors are labeled "reticulum-cell sarcoma." Different pathologists from the same school differ on the criteria on which the diagnosis is to be made. Symmers (18) writes, "If reticulum cells are derived from fibroblasts, the so-

called reticulum-cell lymphosarcoma is not a lymphosarcoma because the unit of growth is not a member of the hematopoietic series. If reticulum cells are derived from lining epithelium, such as that of the sinuses of the lymph nodes, then again, the so-called reticulum-cell sarcoma is not a lymphosarcoma but reticulo-endothelioma. It is evident that the existence of the so-called reticulum-cell sarcoma has been hypothesized on premises which are not tenable, or, in other words, that the conception of a lymphosarcoma composed of reticulum cells is unsound."

In the present case, the diagnosis of reticulum-cell sarcoma was made on biopsy specimens even though the difficulty in differentiating it from carcinoma was admitted. When finally sufficient material was available, it was observed that although there was considerable reticulum present, it was more dense at the periphery of the clumps of cells and scanty or missing in the center.

Since roentgen irradiation is one of the most powerful weapons against certain of these tumors, the radiologist would like to know whether the tumor belongs to the general type of the radiosensitive lymphoma group or to the more radioresistant epithelial group. One would prefer then, as does Schmicke (15), the names *lymphoma* and *lymphosarcoma* for the benign and malignant ones of the former group, and *carcinoma* for the latter.

Epithelial structures forming Hassall's corpuscles may appear in any of the tumors, but their appearance in the extensions and metastases may be taken as evidence of the epithelial nature of the tumor. In this respect, carcinoma of the thymus resembles "lympho-epithelioma" of the pharynx, in which the primary tumor may have a comparatively scanty epithelial component and yet, in its metastases, may appear as an ordinary squamous-cell carcinoma. The lymphoid element need not be taken along in the metastasis.

The present case indicates many of the diagnostic difficulties which present themselves.

CASE REPORT

T. F., a 14-year-old boy, was well until March, 1938, when his ankles began to

cyanotic, although the lips are of fair color. There is no lymphadenopathy. Moderate venous distention of the neck.

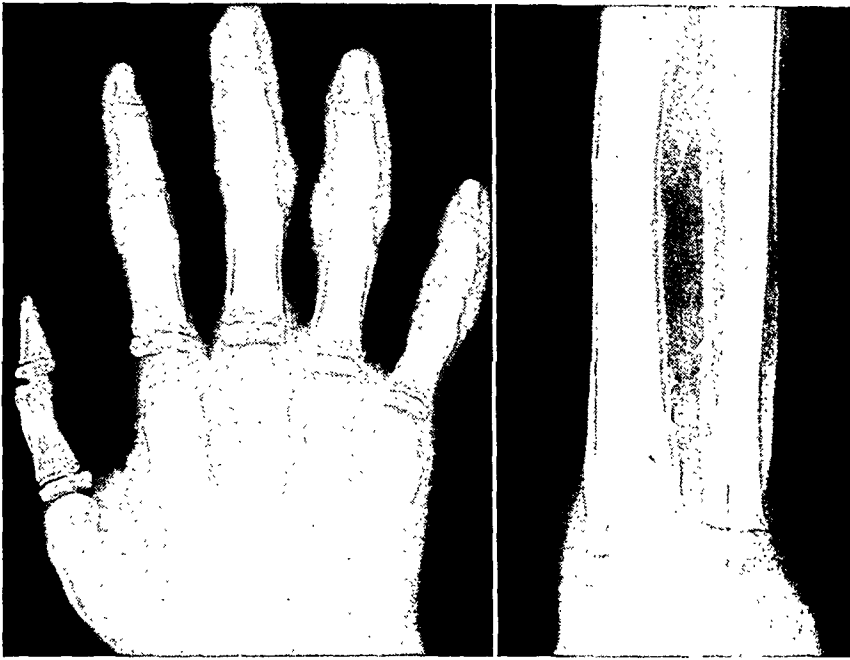


Fig. 2.

Fig. 2. Pulmonary osteoarthropathy in the hands; the terminal phalanges are spared.

Fig. 3.

Fig. 3. Pulmonary osteoarthropathy in forearms. This change involved all of the long bones.

swell and he began to have many chills. He had lost 18 pounds in weight up to his hospital entry on May 17, in spite of the edema of extremities. Two weeks before entry there was a biopsy on the left axillary lymph node, reported lymphadenitis by this department. One week before entry there was a sharp, left-sided chest pain not increased by exertion or activity. No hemoptysis or cough. For the last month the patient had had to sleep on several pillows. With bed rest, the swelling of the feet and ankles had disappeared once, but promptly recurred with activity.

Physical Examination.—Temperature, 38.2° C.; respiration, 20; pulse, 90. The patient is a pale, sick, apprehensive boy, lying propped up in bed, showing obvious weight loss. The skin is dry, warm, and scaling. Finger and toe tips are definitely

Chest examination is negative except for distant breath sounds over the left anterior upper chest. The abdomen is negative. The extremities show striking clubbing of the fingers and toes, thickening of all the joints of the extremities, and a marked non-pitting edema of the hands and feet. There is extreme weakness of the upper extremities. The reflexes are normal and no pathological ones are present.

Laboratory Findings.—Red blood cell count, 3,500,000; hemoglobin, 64 per cent; 10,000 white cells with 80 per cent neutrophils, and no abnormal cells. Urine and stool examinations are negative. Venous oxygen content, 14 volumes per cent; CO₂ combining power, 64 per cent; calcium, 8.0 mg. per cent; phosphorus, 3.1 mg. per cent; phosphatase activity (Rob-



Fig. 4. A, Normal pulmonary artery is demonstrated. B, Heart borders. This appears wide because of the posterior projection at a short distance. C, Tumor.

erts), 18. Sedimentation rate, 30 mm. per hr. (Cutler). Tuberculin, 1:100, negative. Coccidioidin test, 0.1 c.c. of 1:10, negative. Skin and macroscopic agglutination tests for *B. abortus*, negative. Stomach washings negative for tubercle bacilli and fungi by guinea pig inoculation. Scrapings from the mouth showed monilia. Wassermann, negative. All these findings remained essentially constant except for a terminal rise in white blood cell count. EKG on entry: A-V conduction time, 0.18 second; unchanged a month later except T take-off slightly elevated above the iso-electric line in lead 3.

X-ray Examination (May 17, 1938).—There is a large round mass in the left side of the chest which is inseparable from the shadows of the great vessels (Fig. 1). It protrudes backward as well as forward and to the left. It hardly pulsates at all although the heart pulsates moderately.

Dr. Newell thought the shadow in the mediastinum might be tumor, most likely Hodgkin's, although he felt that cyst and dilatation of the pulmonary artery could not be excluded. He advised biopsy of a palpable gland in the left axilla. If this failed to give the diagnosis, he still wished

a therapeutic trial of irradiation on the chance of its being Hodgkin's disease.

On May 19, 1938: Upper and lower extremities all show the changes of pulmonary osteo-arthritis (Figs. 2 and 3).

Progress.—Bronchoscopy on May 20, 1938, revealed carina reddened, right bronchus clear; left bronchus reddened and shows pressure from behind. Biopsy taken from this area in hope that some tumor could be found. Biopsy report showed chronic bronchitis.

Irradiation.—On the presumptive diagnosis of mediastinal Hodgkin's disease, a course of rather light irradiation was undertaken as a therapeutic test. From May 18 to June 6, 1938, 130 kv., filtered to give half value layer 0.3 mm. Cu, 17 r/min. to a 16 cm. circular field centered on the upper mediastinum, was given, 50 r for the first three treatments and 100 r per day for the remainder to a total of 1,050 r (1,365 r skin dose with back-scatter). The mediastinal shadow remained unchanged. Heavy irradiation was, therefore, decided on. From June 7 to June 27, 1938, 350 kv., filtered to give a half value layer of 5.0 mm. Cu, 12 ma., 50 cm. distance, 15 r/min. in air, to a 15 × 15 cm. field, was given. Daily treatments totaling 1,400 r to the posterior chest, and 1,000 r to the anterior chest (20 per cent back-scatter to be added) were given.

At the end of this course of therapy there was still no change in the size of the mass in the chest. The right knee joint was needled and 30 c.c. of straw-colored fluid was withdrawn. This showed only a few pus cells, no aerobic or anaerobic growth, and guinea pig inoculation was negative.

Visualization of Pulmonary Artery.—Since there was no response of the tumor to x-ray therapy, it now seemed impossible to decide with certainty between a radio-resistant neoplasm, a dermoid cyst, and a possible pulmonary aneurysm. In order to rule out the latter possibility, 30 c.c. of 35 per cent solution of diodrast was injected into the cubital vein within a space of two seconds. Films of the chest were taken immediately and at two-second

intervals. The normal pulmonary artery was clearly shown (Fig. 4). Films of the abdomen made a few minutes later showed a normal concentration of the medium in the pelves and ureters of the kidneys. Following this dose (about three times normal size and given as quickly as pos-

sible) there was an immediate choking reaction that lasted a matter of seconds and passed spontaneously, followed by an acute urticarial reaction which, too, lasted only a short time and subsided without specific therapy. There were no other ill effects.

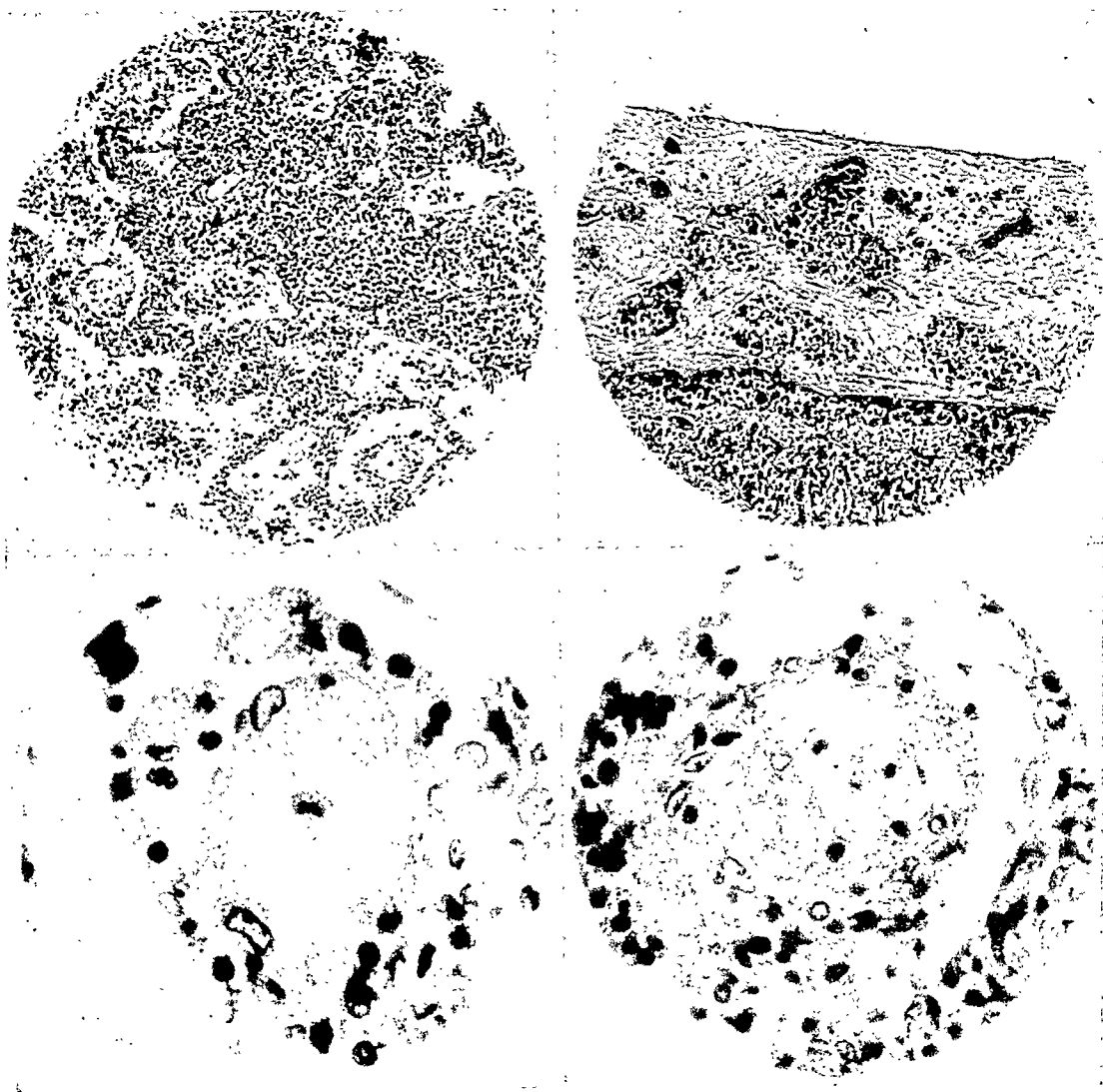


Fig. 5 (*upper left*). Metastatic tumor nodule in the lung. The histology is variable. In some regions the cells resemble lymphocytes crowded into dark masses or scattered in the stroma. In some places the cells are in large masses, with more or less central necrosis. Here the cells, variable in size, tend to be large, some with abundant acidophilic cytoplasm, and others with little cytoplasm.

Fig. 6 (*upper right*). Tumor infiltration in pleura; cells in sharply defined masses, resembling medullary carcinoma.

Fig. 7 (*lower left*). Area from the outer edge of the infiltration in the left lung. There are a half dozen of these spherical masses which closely mimic Hassall's corpuscles. There is acidophilic debris in concentric whorls, and a rim of large cells with nuclei parallel to the circumference.

Fig. 8 (*lower right*). Another area from the left lung in which the tumor mimics Hassall's corpuscles.

Diagnostic Pneumothorax Started.—On July 16, 1938, 75 c.c.; July 17, 1938, 250 c.c.; July 18, 1938, 425 c.c. of air was injected. It was hoped that the thoracoscope might be used for diagnosis, but the lung covered the tumor laterally, the mediastinum was shifted to the right, and the tumor was demonstrated to be anterior to the lung and separated from it.

Operations.—A left thoracotomy was performed on July 21, 1938. Through an anterior left parasternal incision, the left second, third, fourth, and fifth costal cartilages were removed. The pleura was opened laterally. A 5 cm. tumor was exposed beneath the third costal cartilage, intimately attached to the great vessels. Removal was impossible, so only a biopsy was taken. The incision was closed and the patient returned to bed in fair condition. Biopsy was reported: reticulum-cell type sarcoma of the thymus.

The patient developed considerable difficulty in breathing, post-operatively, and a thoracentesis, with the removal of 900 c.c. of air, was done with marked improvement. By July 28, 1938, the wound was healing nicely and there was spontaneous resorption of the air in the pleural cavity.

On Aug. 11, 1938, the patient was again taken to surgery for a second attempt at removal of the tumor. There had been considerable regeneration of the ribs since the previous exploration. The tumor had grown a great deal since the last operation so that now it extended across the midline. It was felt that only total pneumonectomy would have removed the tumor from the left. This was decided against and another biopsy was taken. The patient returned to the ward in poor condition. Biopsy report, sarcoma of the thymus, reticulum-cell type.

On Aug. 22, 1938, stomatitis, gingivitis, and glossitis of monilial origin developed. The patient expired Sept. 22, 1938.

Autopsy, Sept. 22, 1938 (by Dr. William Dock).—The manubrium is firmly embedded in a uniformly gray-pink tumor mass which surrounds the aorta, the basal

0.5 cm. of the great vessels, and invests the upper third of the pericardium. It is 4 cm. thick between the sternum and the pulmonary artery, and the main mediastinal mass is 8 cm. wide. It tapers out over the pericardial sac and into the hila of both lungs but does not extend behind the trachea or main bronchi. The great vessels are compressed but not invaded. Plaques of tumor are present in the left parietal pleura and along the intercostal vessels down to the diaphragm, which also shows a few nodules. The solid mass of tumor at the hilum joins the left upper lobe to the mediastinum. The mass infiltrates into the left upper lobe in streaks and cords which surround blood vessels. The outer and lower portion of this lobe is almost completely airless and contains a few tumor nodules. The left lower lobe and the right lung contain only a few tumor nodules, the largest of which is 2 cm. in diameter. In the mediastinum, on the right, there is a mass of tumor tissue which contains a multiloculated cyst 3 cm. in diameter. The infiltration on the right is limited to the hilum. There is no tumor below the diaphragm.

Summary of Histological Findings (Figs. 5, 6, 7, and 8).—On reviewing the original slides of the axillary lymph nodes, it is possible to identify the strands and sheets of "reticulum" cells which infiltrate next to the capsule in three or four places, and smaller groups of cells in the nodes as the same cells as those found in the tumor. They are larger, have larger nucleoli, and paler nuclear material than reticulum cells usually have. The nodes have reacted to this invasion as to an infection, so that the follicular outlines are lost or are barely discernible even in parts of the nodes where tumor cells are rare. The first substernal biopsy, although it has two degenerated Hassall's corpuscles, has no other structural characteristics of carcinoma. In the second biopsy from the chest, there are alveolar cell masses free of reticulum, although reticulum is abundant throughout most of the tumor. This

reticulum seems derived from the stroma, the fibers being heaviest on the periphery of the cell clumps. At autopsy most of the tumor is unlike sarcoma in that the cells have rather abundant cytoplasm and giant nuclei are not uncommon. Multi-nucleated cells occur, but mitoses are rare. The giant nuclei have sharp boundaries and a fine dark network, together with large nucleoli, but they are almost unstained, except for these features. The large cell masses are free of reticulum, but polymorphonuclear leukocytes are common in those with cellular debris.

Sections of the fibula and metacarpal show a normal marrow cavity in the central two-thirds of the shaft. This is surrounded by dense cortex, perhaps a little thinner than normal, then another concentric ring of marrow, largely fatty and fibrous with rare bone spicules, and then another concentric ring of bone which is fairly dense but has deep pits containing fibrous tissue dipping into it from a thick periosteum (Figs. 9, 10, and 11).

Discussion of the Tumor.—The difficulty in making an accurate diagnosis on this case is easily appreciated when three

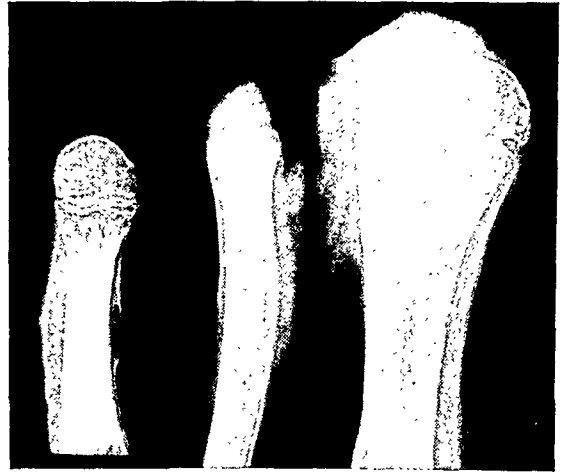


Fig. 9. X-ray of metacarpal, rib, and upper end of fibula. The inner marrow cavity, the cortex, the outer concentric marrow cavity, and new dense bone are well shown.

biopsies failed to reveal its true nature. It was only after re-examination of the specimens with the autopsy material at hand that it was realized that tumor was present, even in the axillary node first seen. The tumor cells closely mimicked reticulum cells, and the reaction of the rest of the node was as to an infection. Only two structures faintly resembling



Fig. 10.

Fig. 10. Longitudinal section of metacarpal showing osteo-arthropathy. *A*, Dense periosteum. *B*, Concentric layer of dense new bone. *C*, Fibrous marrow. *D*, Cortex. *E*, Central marrow. The new bone is subperiosteal and laid down on the old cortex with fibrous, fatty marrow between the two.



Fig. 11.

Fig. 11. Cross-section of rib showing new fibrous tissue dipping deeply into the cortex from the periosteum.

Hassall's corpuscles were found in the material removed at operation and they were so atypical as not to be convincing proof of the epithelial nature of the tumor. However, at autopsy, the evidence of the carcinomatous nature of the tumor was quite convincing. The observed resistance to x-ray treatment is in keeping with the diagnosis of carcinoma.

It seems reasonable to make irradiation the first therapeutic approach to mediastinal tumors. It is relatively safe and simple, while biopsy is hazardous. If the masses melt under relatively small doses, the diagnosis of Hodgkin's disease or lymphosarcoma is justified. Operation is not made more difficult by the previous therapeutic test of irradiation.

It is interesting to note that there was neither clinical nor pathological evidence of myasthenia gravis in this case. Half the cases of myasthenia gravis are associated with some thymic abnormality. Of these, 30 per cent show only a hyperplasia, while 20 per cent are accompanied by malignant tumors, of which lymphosarcoma, perithelioma, and epithelioma have been reported.

Discussion of the Osteo-arthropathy.—I could find no reported case in which pulmonary osteo-arthropathy occurred in this type of tumor, although its development in other mediastinal carcinomas is not rare. A great deal has been written on the subject, "yet in the 44 years that have elapsed since Bamberger first described it, little of real significance has been added to our knowledge of the condition" (Hodges, 1938, 11). Locke (13), Högler (12), and Crump (9) gave excellent reviews of the subject. Crump recognized three components of the disease: a generalized periostitis, clubbed fingers, and a toxic arthritis. Högler recognized three fundamental processes commonly preceding the development of the condition: chronic purulent disease of the chest and lungs, malignant tumors, primary in the lung or mediastinum or in which metastases had occurred in the chest, and biliary cirrhosis. Conditions causing unilateral clubbed fin-

gers, presumably due to pressure on the nerves of one arm, such as aneurysm, and in one case, dislocation of the shoulder, produced only thickening of the soft tissues. The clubbed fingers that occur with heart failure also affect only the soft tissues. However, Locke states that the two conditions should be regarded as identical and that the clubbed fingers are simply an early stage of the true pulmonary osteo-arthropathy. The etiology of the condition is unknown and hypotheses concerning its cause are many. Toxic circulating material, stasis, rheumatic type of infection, tuberculosis, scleroderma, arsenic and iron poisoning, and syphilis have all been suggested. None completely explains all cases. Most of the cases are associated with a rather severe arthritis. As in this case, culture of the fluid from the joints is sterile. Grossly, there is a generalized periostitis affecting all the long bones; it is most severe on the proximal phalanges, metatarsals, metacarpals, and the long bones of the extremities. The forearm and leg are more affected than the upper arm and thigh. The distal phalanges are not affected. In extremely severe cases, even the flat and irregular bones are involved. Histologically, there is first a round-cell infiltration of the periosteum, later a primary layer of dense bone is laid down concentrically, and, subsequently, this becomes porous and the holes are filled with a fibrous marrow.

Discussion of Arteriography.—Arteriography was first carried out in 1923, and was limited mostly to extremities. About 1935, a group in France (1, 2, 3, 4) first demonstrated the pulmonary arterial tree, in the living, by inserting a ureteral catheter through the basilic vein of the left arm into the right heart and injecting a solution of sodium iodide. Apparently the procedure was without danger. It is only recently that injection of contrast medium into the veins of the arm with a syringe has been practised successfully. At a recent meeting of the American Medical Association, Dr. G. P. Robb and Dr. I. Steinberg (19) described their technic.

Twenty c.c. of 70 per cent solution of diodrast is placed in a 50 c.c. Luer syringe; a large needle is attached and is inserted into one of the cubital veins. Twenty c.c. of blood is drawn into the syringe, where the blood floats on the diodrast; the whole is quickly injected, the diodrast floating in first, followed by the blood. Films are taken immediately. These authors say there is no great danger. In our own case there was an immediate choking reaction which passed off very quickly. Later there was an urticarial reaction with quick subsidence. Contiades and others (7) have discussed the dangers of the procedure.

SUMMARY

1. A case of carcinoma of the thymus is reported, in which marked pulmonary osteo-arthropathy was a conspicuous feature.

2. A discussion of the difficulties in the diagnosis of thymic neoplasms is presented.

3. A discussion of pulmonary osteo-arthropathy and pulmonary artery visualization in the living is appended.

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REFERENCES

- (1) AMEUILLE, P., and HINAULT, V.: *Arch. d'élec. méd.*, 45, 136-142, May, 1937.
- (2) AMEUILLE, P., RONNEAUX, G., HINAULT, V., and DESGREZ, H.: *Bull. et mém. Soc. de radiol. méd. de France*, 25, 118-122, February, 1937.
- (3) Idem: *Jour. de radiol. et d'électrol.*, 22, 97-102, March, 1938.
- (4) Idem: *Bull. et mém. Soc. méd. d. hôp. de Paris*, 52, 729-739, May 18, 1936.
- (5) ANDRUS, W. DE W., and FOOT, N. C.: *Jour. Thoracic Surg.*, 6, 648-659, August, 1937.
- (6) BOYD, WILLIAM: *Textbook of Pathology*, second edition, p. 811. Lea and Febiger, Philadelphia, 1938.
- (7) CONTIADES, J., UNGAR, G., NAULLEAU, J.: *Presse méd.*, 43, 1630-1634, Oct. 19, 1935.
- (8) CROSBY, E. H.: *Am. Jour. Cancer*, 16, 461-480, May, 1932.
- (9) CRUMP, C.: *Virchow's Arch. f. path. Anat.*, 271, 467-511, 1929.
- (10) EWING, JAMES: *Neoplastic Diseases*, third edition, p. 971.
- (11) HODGES, PHEMISTER, and BRUNSCHWIG: *Diseases of Bones and Joints*, p. 126.

- (12) HÖGLER, F.: *Wien. Arch. f. inn. Med.*, 1 and 2, 35, 1920.
- (13) LOCKE, E. A.: *Arch. Int. Med.*, 15, 659, 1915.
- (14) RUBASCHOW: *Virchow's Arch. f. path. Anat.*, 206, 141, 1911.
- (15) SCHMICKKE, A., HENKE, and LUBARSCH: *Handbuch der Speziellen path., Anat., und Hist.*, 8, 804.
- (16) SMITH and GAULT: *Essentials of Pathology*, p. 297.
- (17) SYMMERS, D.: *Ann. Surg.*, 95, 544-572, April, 1932.
- (18) Idem: *Arch. Path.*, 26, 603-647, September, 1938.
- (19) ROBB, G. P. and STEINBERG, I.: *Am. Jour. Roentgenol. and Rad. Ther.*, 41, 1-17, January, 1939.

ADDITIONAL BIBLIOGRAPHY

Thymic Tumors

1. ALAJOUANINE, T., HORNET, T., THUREL, R., and ANDRÉ, R.: *Rev. neurol.*, 65, 552-559, March, 1936.
2. BARKER, L. F.: *Ann. Int. Med.*, 5, 1113-1122, March, 1932.
3. BETTMAN, R. B.: *S. Clin. North America*, 12, 1265-1270, October, 1932.
4. BOSANQUET, W. C., and LLOYD, W. E.: *Lancet*, 2, 6-9, July 4, 1931.
5. BREM, J., and WECHSLER, H. F.: *Arch. Int. Med.*, 54, 901-915, December, 1934.
6. Cabot Case 21, 412: *New England Med. Jour.*, 213, 726, Oct. 10, 1935.
7. DECKER, H. R.: *Jour. Thoracic Surg.*, 4, 445-459, June, 1935.
8. ERCKLENTZ, B. W.: *Klin. Wchnschr.*, 15, 1393-1397, Sept. 26, 1936.
9. EVANS, R. G. P.: *British Med. Jour.*, 1, 775-778, April 9, 1938.
10. FISCHER, J. A.: *Jour. Am. Inst. Homeop.*, 29, 738-740, December, 1936.
11. GOLD, E.: *Wien. klin. Wchnschr.*, 48, 694-698, May 18, 1935.
12. HANDI, H., and HALLIS: *Virchow's Arch. f. path. Anat.*, 284, 231, 1932.
13. HASHIGUCHI, M.: *Nagasaki Igakkwai Zassi*, 14, 1468, Sept. 25, 1936.
14. KASILOVA, A. I.: *Russk. klin.*, 14, 445, 1930.
15. LESLIE, M., and BELL W. S.: *British Med. Jour.*, 2, 1,006, 1,007, Dec. 3, 1932.
16. LIÈVRE, J. A.: *Presse méd.*, 44, 991, 992, June 10-17, 1936.
17. LOMAKIN, P. F., and SULIMOVSKAYA, N. A.: *Varch. delo*, 20, 43-46, 1938.
18. MARGOLIS, H. M.: *Am. Jour. Cancer (supp.)*, 15, 2106-2142, July, 1931.
19. NISBET, B. R.: *British Med. Jour.*, 2, 403, Aug. 27, 1932.
20. NORRIS, E. H.: *Am. Jour. Cancer*, 27, 421, 1933.
21. Idem: *Am. Jour. Cancer*, 30, 308-317, June, 1937.
22. OBIDITSCH, R. A.: *Virchow's Arch. f. path. Anat.*, 300, 319-341, 1937.
23. PADILLA, T., and COSSIO, P., JR.: *Semana méd.*, 1, 1459-1470, May 28, 1931.
24. PEER, G. F., and FARINACCI, C. J.: *Mil. Surgeon*, 82, 350-355, April, 1938.
25. SCHMIDT, H. G.: *Röntgenpraxis*, 9, 411, 412, June, 1937.
26. SODA, K., and YOSHIDA, S.: *Nagasaki Igakkwai Zassi*, 15, 2590, 2591, Dec. 25, 1937.
27. STRUTHERS, R. R.: *Canad. Med. Assn. Jour.*, 26, 68-70, January, 1932.

Osteo-arthropathy

28. BAMBERGER, E.: *Bronchiastisie und Veräu-*

- derungeinzeln Röhrenknochen. Wien. klin. Wchn-
schr., 2, 226, March 14, 1889.
29. Idem: Ztschr. f. klin. Med., 18, 193, 1891.
 30. DALE, T.: Acta radiol., 11, 537-545, 1930.
 31. EAST, T.: Proc. Royal Soc. Med., 26, 272, 273, January, 1933.
 32. FRÄNKEL, E.: Fortschr. a. d. Geb. d. Röntgenstrahlen, 25, 1918.
 33. FREUND, E. (Los Angeles): Am. Jour. Roentgenol. and Rad. Ther., 39, 216-227, February, 1938.
 34. HASBROUCK, E. M.: N. Y. Med. Jour., 67, 665, 1896.
 35. KÜHNE, K., and GERSTEL, G.: Fortschr. a. d. Geb. d. Röntgenstrahlen, 46, 662-670, December, 1932.
 36. MARIE, P.: Rev. de med., 6, 297, 1886.
 37. Idem: Rev. de med., 10, 1, 1890.
 38. ODESSKY, J. N., and SHIRSHNEV, P. A.: RADIOLOGY, 30, 250-254, February, 1938.
 40. PENITSCHKA, W.: Beitr. z. klin. Chir., 167, 75-109, 1938.
 41. SHAW, A. B., and COOPER, R. A.: Lancet, 1, 880, 1907.
 42. THORNBURN, W.: British Med. Jour., 1, 1155, 1893.
 43. WEBER, F. P.: Proc. Royal Soc. Med., 2, 187, 1908.
- Arteriography
44. BAZY, L., REBOUL, H., RACINE, M.: Bull. et mém. Soc. nat. de chir., 61, 198-202, Feb. 16, 1935.
 45. BERCZELLER, A., and KUGLER, H.: Arch. f. klin. Chir., 190, 810-815, 1937.
 46. BEUTEL, A., and KLEIN, O.: Med. Klin., 32, 899-902, July 3, 1936.
 47. BIRD, C. E.: Jour. Am. Med. Assn., 109, 1626-1628, Nov. 13, 1937.
 48. BORDONI-POSSIC, C., PALMA, E. C., and ESTABLE, J. J.: Arch. urg. de med., cir. y especialid., 8, 161-178, March, 1936.
 49. BOSCO, J. J., FIERRO, L. L., and ROSALES, E. A.: Rev. méd. del Rosario, 28, 68-82, January, 1938.
 50. DE CARVALHO, L., and ROCHETA, J.: Presse méd., 42, 2057-2060, Dec. 22, 1934.
 51. CHARBONNEL: Bull. et mém. Soc. de chir. de Bordeaux et du Sud-Oest, p. 134, 1932.
 52. CONTE, E., and COSTA, A.: Fortschr. a. d. Geb. d. Röntgenstrahlen, 47, 510-517, May, 1933.
 53. Idem: Radiol. med., 20, 1301-1314, October, 1933.
 54. Idem: RADIOLOGY, 21, 461-465, November, 1933.
 55. DAVIES, H. W.: Med. Press, 196, 487-490, June 1, 1938.
 56. Idem: Bull. et mém. Soc. Nat. de chir., 61, 187, Feb. 6, 1935.
 57. EDWARDS, E. A.: New England Jour. Med., 209, 1337, 1933.
 58. FUCHS, A. W.: Radiog. and Clin. Photog., 13, 10, 11, April, 1937.
 59. GARRAUD, R.: Paris méd., 2, 114-120, Aug. 7, 1937.
 60. HINAULT, V., and DESGREZ, H.: Rev. de la tuberc., 2, 936-943, October, 1936.
 61. HINAULT, V.: Jour. de méd. de Paris, 57, 842-844, Nov. 11, 1937.
 62. VALLERY-RADOT, PASTEUR, LEDOUX-LEBARD, and HAMBURGER, J.: Progrès méd., pp. 945-949, June 6, 1936.
 63. RAVINA, A.: Progrès méd., pp. 1701-1705, Nov. 3, 1934.
 64. RAVINA, A., COTTENOT, P., SOURICE, A., and LESAUCE: Bull. et mém. Soc. méd. d. hôp. de Paris, 52, 770-772, May 18, 1936.
 65. REBOUL, H.: Masson & Cie, Paris, 1935.
 66. RENCZ, A.: Fortschr. a. d. Geb. d. Röntgenstrahlen, 54, 404-410, October, 1936.
 67. SPEHL, G.: Jour. de chir. et ann. Soc. belge de chir., 34-32, 252-256, May, 1935.
 68. ZEHNDER, M.: Zentralbl. f. Neurochir., 2, 281-283, January, 1938.

THE EVALUATION OF ROENTGEN IRRADIATION AS AN ADJUNCT IN THE TREATMENT OF ACUTE OTITIS MEDIA¹

A PRELIMINARY REPORT

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IN many acute inflammatory conditions, roentgen therapy is now recognized as a valuable therapeutic aid, particularly in pyogenic infections. Such recognition is well founded upon experimental and clinical bases. This preliminary study deals with a series of 30 cases of acute otitis media treated with encouraging results by roentgen therapy as an adjunct to the routine care of such cases.

Numerous articles have appeared in recent literature discussing the use of roentgen therapy in the treatment of furunculosis, carbuncles, parotitis, cellulitis, erysipelas, gas gangrene, unresolved pneumonia, and even acute lobar pneumonia. However, comparatively few papers have appeared concerning its use in infections in the field of otology, although important contributions have been made by Granger (2), Schillinger (3 and 4), Crain (5), Cherniak and Gorodetzky (6) in the treatment of mastoiditis; Lucinian (9) on the treatment of otitis media and mastoiditis; Butler and Woolley (7), and Rathbone (8) on the treatment of certain types of paranasal sinusitis.

The rationale for the use of roentgen therapy in acute otitis media is the same as that for other pyogenic infections. Desjardins (1 and 10) has pointed out a factor which is common to all infections, namely, leukocytic infiltration. He believes that the variation in response to different infections may

be due to the degree of this infiltration; that the greater the amount of infiltration, the quicker and more likely a favorable response to radiation therapy. Among others, Warthin (11) has demonstrated experimentally the extreme sensitivity of leukocytes, especially lymphocytes to roentgen irradiation. He noted lymphocytic disintegration within 14 minutes after the exposure. With the destruction of the leukocytes, there is probably an immediate release of antibodies and ferments contained within these cells. This liberation makes these substances more easily available for defense at the site of the local lesion. Certainly in therapeutic doses, roentgen rays have no direct bactericidal effect. A secondary increase in phagocytosis seems well established on experimental grounds (12). A decrease in the swelling and the congestion at the site of the local lesions, following radiation therapy, relieves pain and facilitates drainage. A temporary increase in the swelling and in the pain not infrequently follows roentgen-ray therapy in furuncles and carbuncles. This has not been experienced by us in the treatment of acute otitis media; however, it seems possible that this could also occur in this disease. The character of the discharge in otitis media either remains thin or becomes so, following radiation. This results in adequate drainage of the middle ear cavity. With the reduction of congestion, the eustachian tube tends to be more patent, thus adding to the patient's comfort. Occasionally, drainage from the middle ear is established by this channel. Several patients in the treated group derived such benefit.

In view of the striking improvement brought about in certain cases by the very small doses of radiation, the treat-

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ment may be recommended as a conservative and safe procedure in experienced hands. The dosage (100 r) should cause no skin damage and may be repeated several times without risk to the skin or nearby structures. Its use does not interfere with subsequent operative or other procedures in any way.

The material has been classified into two major groups: a group of 30 cases treated with roentgen-ray therapy as an adjunct, and a control group of 26 cases treated in the usual manner. These were observed in the Strong Memorial and Rochester Municipal Hospitals during the latter half of 1937, and the first six months of 1938. It should be pointed out, that the separation of cases was dependent to a great extent upon the presence or absence of a bulging ear drum, for, in the latter case, myringotomy was preformed and on the issue of purulent material, the diagnosis of acute purulent otitis media was made. Otherwise, the case was classified as acute catarrhal otitis media. In the irradiated group are 15 cases of the latter, as well as 15 cases of acute purulent otitis media. The purulent cases are further divided into uncomplicated and complicated cases (mastoiditis, petrositis, etc.). Unfortunately, there are no catarrhal cases in the control group. All 26 control cases (diagnosed as acute purulent otitis media) were divided into uncomplicated and complicated groups.

For the purpose of this paper, the term "mastoiditis" has been empirically used when this complication of the otitis media was severe enough to suggest surgical interference. The cases showing simple inflammation of the mastoid, which accompanies the majority of severe cases, were classified as uncomplicated, acute, purulent otitis media.

All cases were handled in the customary manner, roentgen-ray therapy being added to the irradiated group as an adjunct to the routine care and treatment of such cases of acute otitis media. A myringotomy was performed on all middle-ear infections needing immediate drainage in

this group. This was followed by roentgen-ray therapy. If seen early enough, the catarrhal group was treated with roentgen-ray therapy and observed. The cases have been analyzed with the following questions as objectives: (1) Does roentgen-ray therapy shorten the average course of the disease? (2) Does it lessen complications? (3) Is it of value in the treatment of complications?

Control Group.—The control group was picked at random from out-patient and house records over a period of 12 months, no attempt at selection being made, and no catarrhal cases being recorded. In this group the average duration of the disease on admission was 7.9 days (Chart I). The average duration of the symptoms after the institution of treatment was 29.6 days with an average total illness of 37.5 days. Spontaneous rupture of the tympanic membrane had occurred in 16 cases (over 60 per cent) at admission. The remaining 10 cases had a myringotomy performed while under observation. The 18 uncomplicated cases were seen on an average of 5.1 days after the onset of the symptoms, with an average duration of 22.1 days after the institution of treatment, making an average total duration of 27.2 days.

Among the 26 control cases, there were eight which were complicated by acute mastoiditis requiring operation. Five of these were admitted to the hospital at the first visit, with a well-developed mastoiditis. Three developed mastoiditis while under routine treatment. This may be contrasted with the mastoiditis cases in the irradiated group in which only one case out of four needed surgery after irradiation.

In 1937, and the first six months of 1938, there were 192 cases of acute, purulent otitis media serious enough to be admitted to the hospital for treatment. Of these, 55 (28.6 per cent) had surgical mastoid procedures for relief of symptoms, which corresponds quite closely to the incidence in the control group of 26 cases (30.8 per cent).

Roentgen-ray Therapy Group.—Of the 15 cases of acute catarrhal otitis media, myringotomy was necessary after irradiation in

only one instance. The average duration of the disease, before roentgen-ray therapy, was 2.1 days (Chart II). The duration of the disease after irradiation was 6.5 days, making an average total duration of 8.6 days. All of these cases might have done equally well without roentgen-ray therapy,

but it was noted that the pain was materially decreased almost immediately after the treatment, and there were no resulting complications. In the absence of similar cases in the control group, no comparison is possible, although the short time of duration after treatment and the absence of complications in this group is suggestive.

It is interesting to note that the 15 *purulent cases* were of longer duration before coming for treatment as were also those in the control group, and 12 required myringotomy before the roentgen-ray therapy. There was spontaneous rupture of the tympanic membrane in three cases. The average duration of these 15 cases, after irradiation, was 21.5 days, with an average of 27.9 days, total duration. Of course it is impossible to say what the outcome of these cases would have been had they been seen at the very onset since myringotomy was necessary in only one out of the 15 cases treated in the catarrhal stage.

A careful study of Chart II reveals that 11 of the uncomplicated cases of purulent otitis media were seen on the average of 4 days after the onset of the disease. These had symptoms for an average duration of 17.6 days after roentgen-ray therapy, with a total average duration of the disease of 21.7 days. The other four cases were complicated with mastoiditis. Two cases developed definite mastoiditis before roentgen-ray therapy was instituted and made an uneventful recovery without surgical interference. One case was complicated by mastoid involvement while under observation after therapy, and surgical interference was necessary. The remaining case in this group perhaps should not have been included as mastoiditis, although surgery was considered because of the acuteness of the condition, and the inadequacy of the history of duration. Surgery was not necessary, however, after irradiation.

In most cases, the irradiation seemed to relieve the symptoms and shorten the course of the disease. The duration of the discharge was materially lessened over those cases not receiving roentgen-ray

CHART I.—ACUTE OTITIS MEDIA
Cases without Roentgen-ray Therapy
(Controls)

Classification	No. Cases	Average Duration before Admission	No. Treated 100 r Each	Average Duration after Admission	Average Total Duration of Disease	Percentage Purulent with Mastoiditis	Percentage Mastoid-ectomy	Remarks
Catarrhal	0							
Purulent including complications	26	7.9 days	0	29.6 days	37.5 days	14.3 per cent developed under treatment		4 bilateral 22 unilateral
Purulent without complications	18	5.1 days	0	22.1 days	27.2 days			
Purulent with advanced mastoiditis	8	14.1 days	0	46.6 days	61.0 days	30.8 per cent total	100 per cent	5 mastoiditis on admission 3 developed mastoiditis during treatment

therapy. The reduction of swelling of the parts involved improved the channels for drainage. The purulent material changed its character to that of a more watery consistency which also made better drainage possible.

RADIATION TECHNIC

One hundred r units were administered to the involved side (or to each side, if the condition was bilateral) with the following factors: 200 kv. (peak), 25 ma., 50 cm. target-skin distance, 0.485 mm. copper plus 1.0 mm. aluminum filtration. The size of the portal varied with the individual but was sufficiently large to include the ear, mastoid region, and posterior nasopharynx. Most of the patients required only one treatment. If the condition responded slowly, and immediate surgery was not indicated, a second treatment was given within from 48 to 72 hours. Of the 30 patients treated, 25 had one treatment each, and five had two treatments each (Chart II).

CASE HISTORIES

Case 1. F. M., a four-year-old boy, was admitted to the Municipal Hospital, on April 20, 1938, with the chief complaint of bilateral earache of five days' duration. This was unusually severe in the right ear. One week prior to admission, he contracted a mild upper respiratory infection. Five days previous to admission a myringotomy was performed on the left ear, followed shortly by a like procedure on the right ear. Examination revealed both ear drums adequately perforated. There was a moderate amount of pulsating purulent discharge in each external auditory canal but greater on the right. The right mastoid process was tender to pressure. Temperature on admission was 39.0° C., and the white blood cell count was 11,700. Roentgen examination of the mastoids revealed bilateral clouding, more marked on the right. There was no evidence of destruction of the mastoid cells. Cultures from the exudate taken from the external auditory canals showed *Micrococcus catarrhalis* and

CHART II.—ACUTE OTITIS MEDIA
Cases Treated with Roentgen Rays

Classification	No. Cases	Average Duration before Treatment	No. Treated 100 r Each	Average Total Duration after Treatment	Average Total Duration of Disease	Percentage Purulent with Mastoiditis	Percentage Mastoidectomy	Remarks
Catarrhal	15	2.1 days	14 1 treatment 1 2 treatments	6.5 days	8.6 days			1 myringotomy later 8 bilateral 7 unilateral
Purulent including complications	15	6.4 days	11 1 treatment 4 2 treatments	21.5 days	27.9 days	8.3 per cent developed under treatment		6 bilateral 9 unilateral
Purulent without complications	11	4.0 days	8 1 treatment 3 2 treatments	17.6 days	21.7 days			
Purulent with advanced mastoiditis	4	12.8 days	3 1 treatment 1 2 treatments	33.2 days	45.0 days	26.6 per cent total	25	1 early mastoid tenderness 2 mastoiditis before treatment, no operation 1 mastoiditis following treatment, with operation

Diphtheroid bacilli from the left, and *Pneumococcus*, Type I, from the right.

Despite routine treatment, the temperature continued to rise in the evening to 38.5°C .– 39.8°C . for the next 48 hours. Forty-eight hours after admission, 100 r was applied to each ear and mastoid process. On the following day the highest recorded temperature was 37.5°C . Improvement was sufficiently great to permit discharge from the hospital, three days after admission, with referral to the clinic.

The patient's first admission to the clinic was on April 26, at which time the ears continued to drain moderately. There was no pain nor mastoid tenderness. On May 3, eleven days after irradiation, each ear had returned to normal and the child was discharged from the clinic.

The above case was that of a severe, bilateral, purulent otitis media in which there was no complicating mastoid involvement (see empirical classification) other than simple inflammatory changes such as are present in most cases of severe acute otitis media. Such satisfactory response to roentgen therapy did not occur with every patient treated, but serves to illustrate that an encouraging result can be obtained. The beneficial response within 24 hours was a "rather typical finding in most cases which responded to this type of therapy."

Case 2. H. B., a 65-year-old white, diabetic female, was admitted to the Rochester Municipal Hospital, on April 8, 1938, with a history of head cold and pain in the right ear for the two weeks prior to admission. This was associated with right-sided temporal headache, tinnitus, and deafness, and profuse nasal discharge. On admission, a slight amount of purulent material was draining out of the right external auditory canal. The right ear drum was tense and bulging. Both antra failed to transilluminate light and both nostrils were filled with purulent discharge. Roentgenograms of the mastoids at this time revealed beginning destruction of the bony cells. The urine showed 4 plus sugar; blood count, W.B.C., 15,500.

Under gas-oxygen analgesia, a right myringotomy was performed. Only a small amount of thick purulent material was released, which, when cultured, showed the presence of *Pneumococcus*, Type III. The right ear did not drain well, and on April 15, 1938, the patient was given her first dose of irradiation. Immediately the pain subsided and the temperature, which had ranged about 38.5°C ., dropped to normal. Drainage was still inadequate and a second dose of irradiation was administered on April 19, 1938, four days later. From then on the discharge became less stringy and more watery and the patient made an uneventful recovery, being discharged May 17, 1938, with a dry ear. The maxillary sinusitis was treated by irrigation every other day at first. Bilateral naso-antral windows were made after the third irrigation, due to the uncoöperation of the patient. The diabetes was controlled while the patient was in the hospital. The experience in this clinic with *Pneumococcus*, Type III, mastoid infections in elderly persons, with or without diabetes, has been that the majority of these cases has required surgery. This patient made a satisfactory recovery without surgical interference.

The effect of the radiation here is rather typical, although two doses were required to bring about the desired result. The following case reports are illustrative of inadequate dosage, the necessity for repeated doses in certain cases, and in others the failure to respond.

Case 3. T. M., a 23-year-old, white female, was admitted to the Rochester Municipal Hospital, on November 11, 1937, quite ill, with a history of an acute upper respiratory infection and bilateral earache, for 48 hours prior to admission. The temperature was 39.3°C . The W. B. C. on admission was 6,250, with polymorphonuclears, 86 per cent, lymphocytes, 13 per cent, and monocytes, 1 per cent. Three days later the W. B. C. rose to 8,300, polymorphonuclears, 84 per cent, lymphocytes, 14 per cent, and monocytes, 2 per cent. Both drums were bulging, and

myringotomy released pus under pressure from which *Pneumococcus*, Type I, was cultured. Both antra were irrigated with return of foul-smelling purulent material. Her first dose of irradiation was administered on admission after myringotomy. The pain and discharge were unaffected, however, and her temperature remained elevated. Both antra were irrigated every other day. Five days after the first, a second dose of irradiation was administered. This was promptly followed by a fall in temperature and cessation of pain. The exquisite mastoid tenderness to pressure, present on admission, diminished. Progress henceforth was uneventful, and the patient was finally discharged Dec. 29, 1937, 49 days from the onset, with no discharge present and hearing normal. From the onset, because of the severity of the middle ear infection, the sinusitis, and general toxemia, it was felt that this patient would probably eventually develop a mastoid complication needing surgery.

In this case, the first dose of radiation was insufficient. The second dose should have been given much earlier; in fact, as soon as it was evident that the initial dose was insufficient. Usually this is apparent within 24 hours.

Case 4. L. R., a 54-year-old Italian male, was admitted to the Rochester Municipal Hospital, on Feb. 19, 1938, with the history of pain in the right ear for two days, following a mild upper respiratory infection. The right ear drum was bulging. The nasal sinuses were not involved. Temperature was normal; W. B. C. ranged from 9,800 to 10,000. A right myringotomy was performed shortly after admission with release of pus under pressure. Culture demonstrated the presence of *Staphylococcus albus hemolyticus*, and *Pneumococcus*, Type I. He continued to complain of pain behind the right ear radiating over the right eye and frontal region. The ear continued to drain, so that six days after myringotomy he was given a dose of irradiation. This did not help the pain or the discharge. Sulfanilamide was tried but the patient did not tolerate it well. Eventually, a simple

right mastoidectomy was performed, and two distinct infected cell tracts were dissected well into the petrous portion of the temporal bone. Post-operatively, the patient developed erysipelas and had a most stormy convalescence. The ear continued to drain profusely and the eye pain persisted for several weeks. Eventually, the discharge abated, and on May 5, 1938, 78 days from the onset, the patient was discharged with a dry ear.

This case is unusual in itself, and the final outcome was fortunate for the patient for there were times during his illness when the prognosis was grave. This is the only case of purulent otitis media which had mastoidectomy. In view of the extensive complications, experience at this time was not sufficiently advanced to permit follow-up roentgen treatment. It has been found to be worth while in some cases (Case 2 and 3), and probably would have been of benefit in this case had it been applied before the mastoidectomy.

Case 5. L. D'B., an 11-year-old male, was admitted to the Rochester Municipal Hospital, on Feb. 8, 1938, with a history of purulent discharge from the right ear following spontaneous rupture of the drum. The present illness followed an acute upper respiratory infection. On examination, a profuse purulent discharge was observed, oozing from the right external auditory canal. There was marked swelling of the zygomatic and retro-auricular regions, pushing the ear out and giving the typical appearance of an acute zygomatic mastoiditis. Both nostrils were filled with purulent material, and transillumination was opaque for both antra. Bilateral antral irrigation was performed with a return of thick foul-smelling pus. The culture from the right ear canal showed *Streptococcus hemolyticus*, and *viridans*, and *Staphylococcus aureus*. Roentgen examination showed a diffuse clouding of the right mastoid with indications of beginning disintegration of the mastoid cells. Temperature on admission was 38.2° C.; W. B. C., 18,600; polymorphonuclears, 82 per cent; lymphocytes, 16 per cent; mono-

cytes, 2 per cent, and many stab cells reported.

The morning following admission, roentgen-ray therapy was administered and full therapeutic doses of sulfanilamide begun. The radiation brought about dramatic relief of pain and fever within 24 hours, which was before the effective sulfanilamide dosage level was reached. The antra were irrigated every other day and the ear wiped dry every two hours. Drainage was adequate. Progress was gratifying and the patient made an uneventful recovery in 14 days (15 days in the hospital). This boy was admitted on April 1, 1938, to the contagious division with scarlet fever complicated with mild acute purulent right otitis media (*Streptococcus hemolyticus* again), but no mastoid involvement or sinusitis. Sulfanilamide was again administered but no radiation was given. He made an uneventful recovery from both scarlet fever and the mild otitis media and was discharged on April 25, 1938.

The question immediately arises as to the individual benefits derived from the two types of therapy used in the first admission. Certainly the value of sulfanilamide in the treatment of infections with hemolytic streptococcus has been established beyond question. Since this patient needed all of our therapeutic resources on the first admission, the drug was not withheld in order to determine the outcome of roentgen therapy alone. On the second admission, the otitis media was a minor factor, so that radiation was not contemplated.

DISCUSSION

It is felt that in the small series of 30 cases presented here, roentgen-ray therapy has been of distinct value in aborting acute catarrhal otitis media, in shortening the course of acute purulent otitis media, and in lessening the incidence of surgery in those cases of acute purulent otitis media complicated by "surgical mastoid." There are many variables entering the picture, which make it both difficult and unwise to draw final conclusions concerning the re-

sults. Some of these are represented by the seasonal trends, the type and virulence of the infective agent, the duration of the infection when first seen, the treatment already instituted, and many other factors. Roentgen irradiation is not a panacea and may not be effective in every case. It will, however, be interesting to follow the reports of results of this therapeutic agent in the hands of others. We wish to emphasize that the clinical care of these patients should be in the hands of an otologist so that accepted methods of management can be properly carried out.

Five cases in the irradiated group were also treated with sulfanilamide. Two are described as No. 4 and No. 5. The three others seemed to have somewhat shorter courses than the controls, or those with sulfanilamide alone. These cases were so complicated by factors other than the otitis media that a critical analysis of the effectiveness of the combined treatments is impossible with such a small number of cases.

It is significant that the irradiation was not restricted to any one type or class of patients, since the groups included children and adults. The infectious agent involved likewise varied. Diabetes was not a contra-indication; in fact, in this type of case, radiation probably has much to offer, with little risk to the individual.

CONCLUSIONS

1. Thirty cases of acute otitis media treated with one or more doses of 100 r, and 26 unirradiated controls are analyzed in this preliminary report.

2. Even in these small doses, the irradiation seemed to be of distinct value in relieving the acute symptoms and in shortening the course of the disease. The average duration of the disease for the acute, purulent, uncomplicated cases was shortened six days, while that of the complicated cases was shortened 16 days. The clinical improvement when the treatment is effective is much more striking than these figures would indicate.

3. The incidence of surgery was apparently reduced.

4. The treatment seems to us a conservative method, since it does not interfere in any way with other forms of treatment if they become necessary, and it causes no permanent damage with this dosage. As with the other forms of treatment, better results are obtained in the early stages of the disease.

BIBLIOGRAPHY

- (1) DESJARDINS, A. U.: Radiotherapy for Inflammatory Conditions. *Jour. Am. Med. Assn.*, 96, 401-408, Feb. 7, 1931.
- (2) GRANGER, A.: The Treatment of Infections of the Mastoids of Infants when there is no Sign of Destruction Present, with Fractional Doses of Roentgen Rays. *New Orleans Med. and Surg. Jour.*, 84, 111-113, August, 1931.
- (3) SCHILLINGER, R.: The Apparent Therapeutic Effects of the Roentgen Ray upon the Clinical Course of Acute Mastoiditis. *RADIOLOGY*, 18, 763-776, April, 1932.
- (4) Idem: Roentgenologic Aspects of Mastoiditis.

- Am. Jour. Roentgenol. and Rad. Ther.*, 39, 193-201, February, 1938.
- (5) CRAIN, C. F.: Roentgenologic Considerations in Infant Mastoiditis. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 592-601, October, 1937.
- (6) CHERNIAK, W. P., and GORODETZKY, A. A.: Roentgen Therapy in Acute Mastoiditis. *Jour. Laryng. and Otol.*, 49, 675-678, October, 1934.
- (7) BUTLER, F. E., and WOOLLEY, I. M.: Roentgen Therapy in Chronic Sinusitis. *RADIOLOGY*, 23, 528-537, November, 1934.
- (8) RATHBONE, R. R.: Roentgen Therapy of Chronic Sinusitis in Children. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 102-108, July, 1937.
- (9) LUCINIAN, J. H.: Treatment of Otitis Media and Mastoiditis by the Roentgen Ray. *Am. Jour. Roentgenol. and Rad. Ther.*, 36, 946-953, December, 1936.
- (10) DESJARDINS, A. U.: X-ray and Radium in the Treatment of Skin Diseases. MacKee, pp. 269-287. Lea and Febiger, Philadelphia, 1938.
- (11) WARTHIN, A. S.: An Experimental Study of the Effects of Roentgen Rays upon the Blood-forming Organs, with Special Reference to the Treatment of Leukemia. *International Clinics*, 4, 243-277, 1906.
- (12) LILL, WULFF, B. I., and WARREN, S. L.: The Effect of Roentgen Radiation on Experimental *Staphylococcus* Infection in Dogs Simulating Furuncles or Boils. (Unpublished.)

THE ROENTGEN THERAPY OF CAREFULLY SELECTED SINUS INFECTIONS¹

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THE increasing number of articles in the literature, especially those by Osmond, Manges, Rathbone, Woolley and Butler, and Waters and Firor, would certainly indicate that irradiation of some types of sinus infection has proven to be of definite therapeutic value.

As stated by one of the writers in a previous article, "For fifteen years a preliminary sinus film has been made on every patient sent in for chest examination, unless the pathology found seemed to be

sufficient to explain the symptoms, and in all in which there was an increase in the lower lobe bronchovascular shadows. These films disclosed numerous unsuspected sinus infections. Many of these were cases of prominent physicians who had not in any way suspected these infections. Also many were in persons who had been treated by one or more rhinologists and were thought to be cured of the disease." These findings we believe prove: (1) that sinus disease is far more prevalent than is usually believed; (2) that on account of the meager symptoms its diagnosis is being overlooked in the majority of in-

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

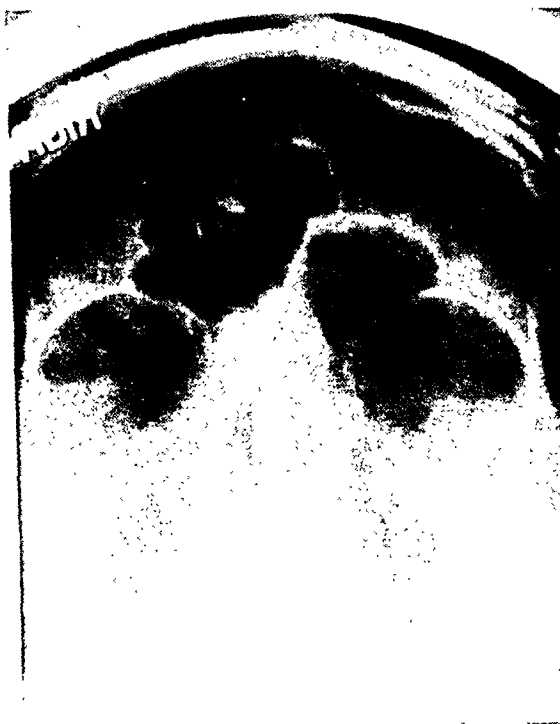


Fig. 1.

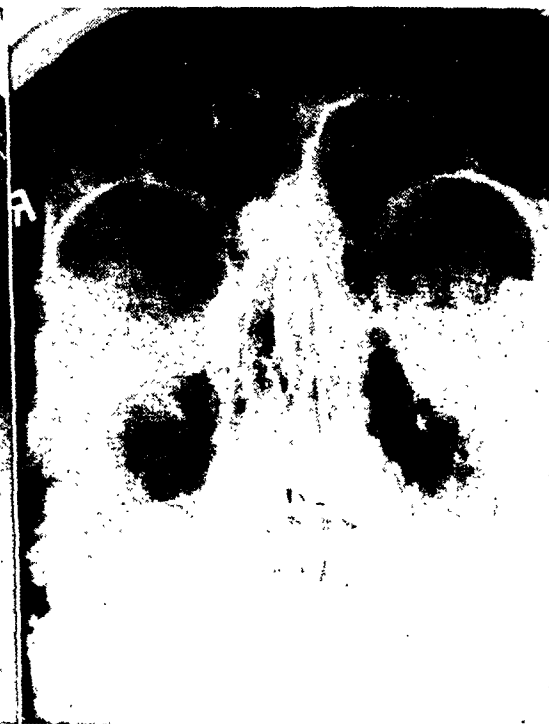


Fig. 2.

Fig. 1. Case 1, Group II, Sept. 17, 1936. B. P., white, male, 15 years of age. Film shows cloudiness of the frontals, marked cloudiness of the ethmoids, and thickened membrane in both antra. He was 20 pounds underweight, had a severe cough, headaches, swollen turbinates. Consistently under rhinologist's care for three years. Antra had been washed a number of times. Chest films show definite increase in the bronchovascular shadows to the lower lobes.

Fig. 2. (Oct. 27, 1936.) Film shows the sinuses almost clear. Following irradiation over the sinuses and chest the clinical symptoms disappeared. He gained weight and has been perfectly well since that time.

stances; (3) that the treatment is frequently inadequate and, (4) that in many instances no accurate method of checking the results of therapy is being routinely used.

An article in 1934, by Butler and Woolley, gives the results of some excellent experimental work. They "used twelve cats, in which the right frontal sinuses were punctured and infected with a virulent, hemolytic, streptococcic culture taken from a mastoid. All the cats showed definite evidence of infection within a few days and two died as a result of it." These investigators "determined upon three weeks as the duration under which infection would be kept alive and at the end of this time the remaining ten cats were sacrificed and divided into three groups."

Group I consisted of three cats which were irradiated over both frontal sinuses and given 800 r in air. Group II consisted of three cats which received 1,600 r over both frontals, the increased dose being given in order to determine if, and

what, harmful results might occur from excessive radiation. Group III consisted of the four remaining cats which had been infected, but were not irradiated, and these were used as controls.

One cat from each group was killed at the end of one week, a second at the end of three weeks, and a third at the end of three months following irradiation. "The sinuses were exposed for gross inspection and the anterior portions of the skulls were then placed in Zenkerformal solution. After the membranes had hardened they were rolled, blocked, sectioned, and stained." Butler and Woolley then, "studied the effects of irradiation after a few days and accordingly another series of cats was prepared, as before, and killed 24, 48, and 72 hours following irradiation. The membranes were processed as above mentioned."

In summarizing the effect of irradiation on infected membranes of the sinuses they report as follows: "The effect of the x-ray treatment appears to be due primarily to

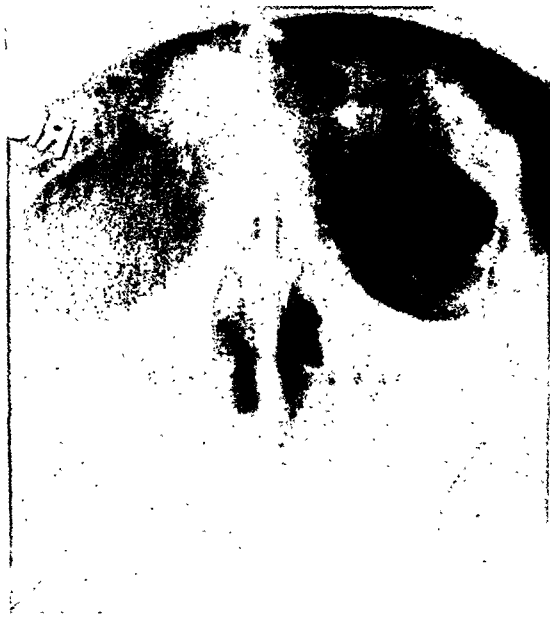


Fig. 3.

Fig. 3. Case 2, Group III, April 30, 1937. W. D. W., white, male, 40 years of age. Film was taken a few minutes after washing and shows marked cloudiness of the ethmoids, cloudy frontals, and the antra less constantly under the care of a rhinologist and the antra were washed a good many times.

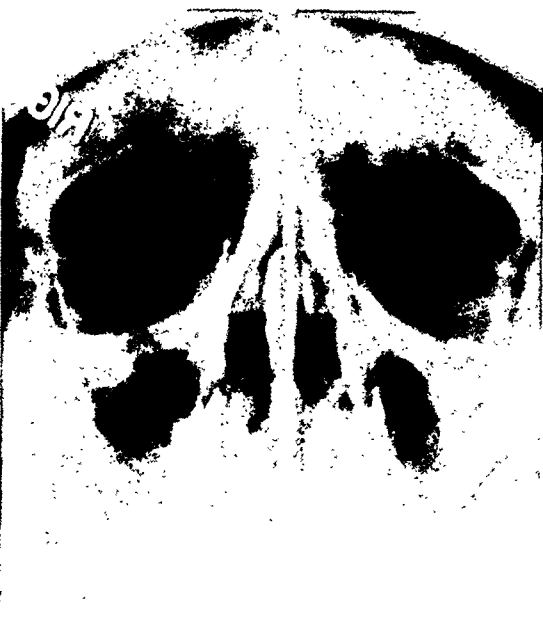


Fig. 4.

Fig. 4. (May 18, 1937.) Film shows the sinuses almost clear. Clinically, the cough has almost entirely disappeared.

an early destruction of the lymphocytes in the infected membranes. From 48 to 72 hours after treatment of membranes, which had been infected for several weeks, there appears to be an increase in the number of macrophages. These are believed to come in response to substances released by the breaking down of the lymphocytes. These macrophages are seen to be laden with cellular debris and dead pigments. It is possible that they also engulf bacteria.

"The membrane becomes gradually reduced in thickness but retains numerous plasma cells, polymorphs, and some histocytes. After a week or more some fibrosis appears.

"There is no evidence of injury to the cilia, epithelium, or cellular elements other than the lymphocytes as the result of x-ray dosage. The fibrosis is considered a

result of the inflammatory process and the increased number of histocytes immediately following the infection."

From these experiments, and from the well established value of irradiation in many other infections, as reported in many publications, it would certainly seem that we must admit there is justification for radiation treatment of sinusitis.

In a previous article, one of the writers gave a classification of sinus infections as to radiosensitivity; also, Waters and Firor, in a recent article, gave a similar one and our recent work has emphasized the value of this classification.

Group I. Acute sinusitis, in which there is good drainage, will generally clear up fairly quickly under the usual treatment of astringents, packings, and washings. In these cases we do not feel radia-

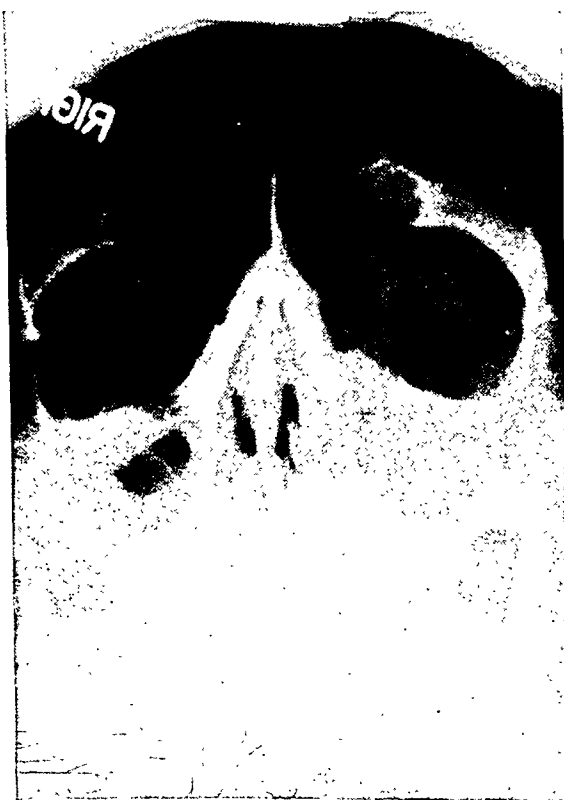


Fig. 5.

Fig. 5. Case 3, Group III, Oct. 28, 1937. J. N. W., white, male, 42 years of age. Film shows the left antrum absolutely dense, so this was washed out. Had had sinus trouble for 15 years. Had been under several different rhinologists and had the antra washed many times.

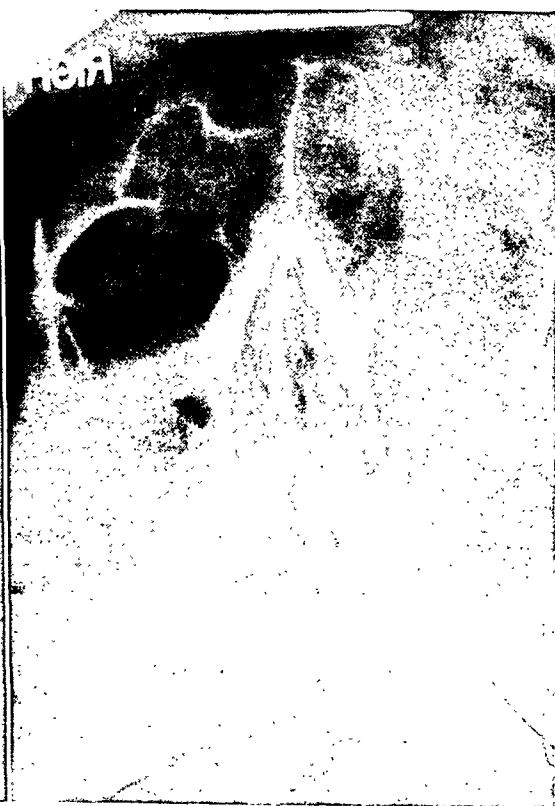


Fig. 6.

Fig. 6. (Oct. 28, 1937.) Film was made immediately after washing. A small amount of pus was obtained. The patient was advised either to have radical operation on the two sides or to try x-ray.

tion is necessary unless it is used to hasten recovery.

Group II. This is the type of case that has, in our experience, responded best to irradiation. Such cases would be classified clinically as sub-acute or sub-chronic. Symptoms have been present for from

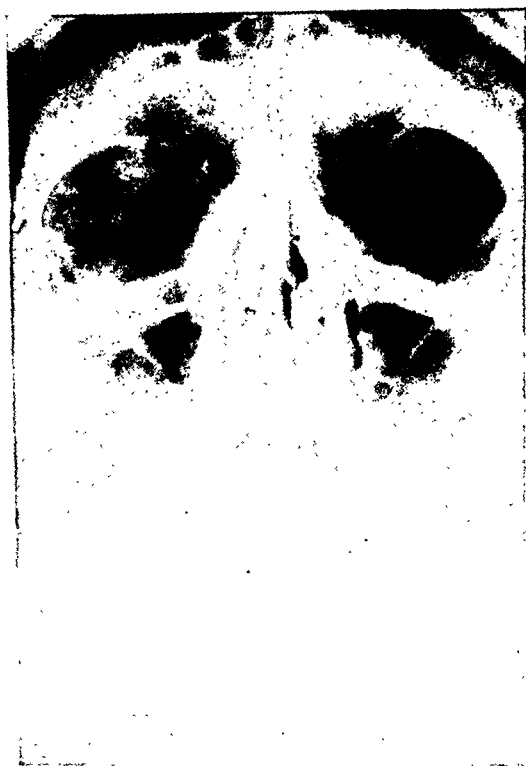


Fig. 7. (Nov. 11, 1937.) This film was made only two weeks later. The patient went through the winter without any further treatment to the sinuses, the first winter in 15 years that he had been able to go longer than a few weeks without sinus treatment.

several months to several years; usually there is a cough, a history of recurring colds, and the patient has been under the care of one or more rhinologists. Films show cloudy ethmoids with marked thickening of the membrane in the antra. Washings cause little or no change in the appearance of the antra, showing that there is little or no free pus. In many of these cases the bronchovascular shadows of the lower lobes are exaggerated.

Group III. Symptoms have been present for several years, usually with hyperplastic sinusitis. There is marked cloudiness of the ethmoids, and marked thickening of the membrane in the antra. Group II gradually shades into Group III and an accurate history is essential in many instances for a proper classification. Usually, the longer the duration of the infection, the poorer the result. The majority of these cases have also responded to irradiation. In Groups II and III, with cough and increase in the bronchovascular shadows to the lower lobes, small doses are also applied over the lungs. This is, we believe, of definite benefit.

Group IV. Early, or reasonably early polypoid changes, especially in the nose, with a history of infection for many years. This diagnosis naturally has to be made by the rhinologist in many instances. In a majority of these patients, marked relief followed irradiation. A number have had return of the sense of smell and two have had marked improvement in vision following treatment. Others, who were unable to breathe through the nose at all, have been relieved in this respect. Some who had to have repeated operations for removal of polypoid material from the nose have had no recurrence of this.

Group V. Old, exceedingly chronic polyp formation, usually widespread, is present. Only a small percentage of these cases have received much benefit from irradiation. However, a few of from 15 to 20 years' duration have received definite benefit from treatment.

Groups I, II, and III have been treated with 130 kv.p. with 6 mm. aluminum filter, about 300 r measured in air, given in three or four treatments, over a period of from one to three weeks. Children have been given smaller doses. Groups IV and V have been treated with 200 kv.p. with from 0.5 to 2 mm. copper filter, 600 r measured in air.

Since almost every patient should be seen by both rhinologist and radiologist for diagnosis and follow-up of the results of the treatment, a whole-hearted and

sincere co-operation between these two is absolutely essential, if the best results are to be obtained.

We realize that many radiologists are obtaining just as good or better results than we are, while others are getting nowhere in the treatment of sinusitis. This is, we believe, due largely to the fact that series of cases, which have been failures by other methods of treatment, are routine through a busy clinic without any careful study or individualization by rhinologists and radiologists. Except for the very few specifics that we have in medicine, almost any type of therapy can, save in

a small percentage of cases, lead but to failure.

If the radiologist realizes his limitations, and co-operates with the rhinologist and internist experienced in allergy and treats only the types of cases enumerated in this paper, we believe a great deal can be accomplished by irradiation in this field.

We are more enthusiastic than ever before over the results that can be obtained by irradiation in the treatment of certain types of infections of the nasal accessory sinuses, and our conclusions are about the same as those expressed in previous papers.

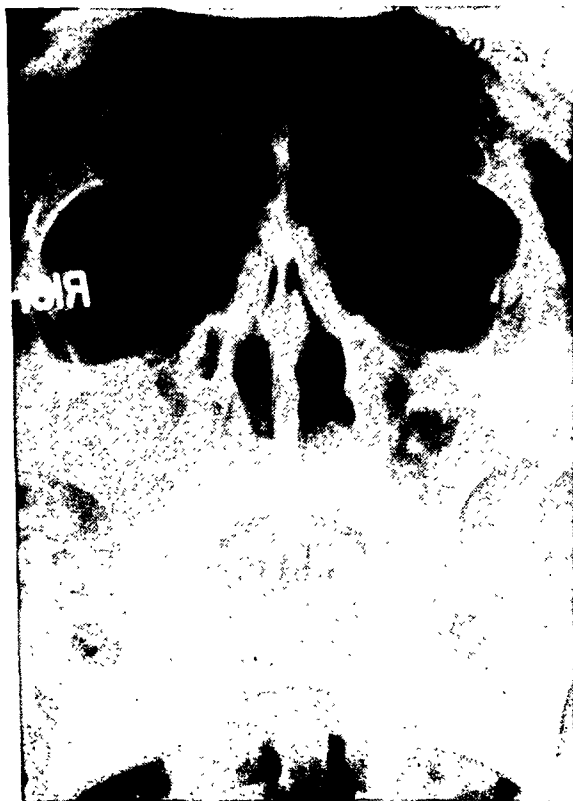


Fig. 8.

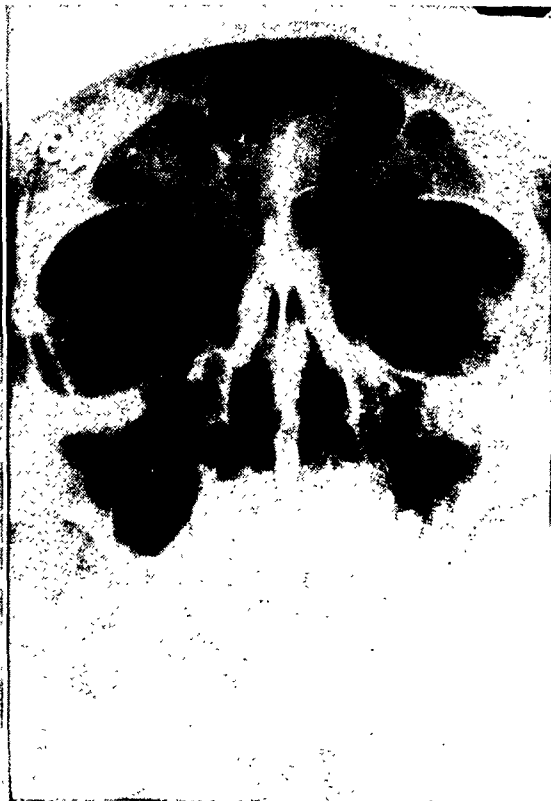


Fig. 9.

Fig. 8. Case 4, Group IV, Sept. 20, 1937. G. P. McC., white, 28 years of age. Film shows right antrum practically dense. Left antrum shows marked thickening of the membrane. Ethmoid area shows widening, with the type of density usually seen in polyp formation. The patient has had sinus trouble with frequent colds, cough, and nasal discharge for many years. Was under care of allergist for several months, and under care of rhinologists at frequent intervals; at one time for six months, during which time she had frequent washings of the antra. Polyps were removed from the nose six years ago. She had further polyp formation and was unable to smell.

Fig. 9. (Oct. 23, 1937.) The patient was treated in September, 1937, and considers that she has been 90 per cent relieved of symptoms. Has a return of the sense of smell. There is still slight thickening of the membrane in the antra, but there has been marked decrease in the pathology as shown on the film as well as improvement in the clinical symptoms.

SUMMARY

1. Sinus disease is a far more common, complicated, and serious condition than is realized by the general medical profession.
2. Almost every common cold that does not clear up within a reasonable time is a sinus infection. Many are due to allergy.
3. Preliminary sinus films, on patients sent in for chest examinations, disclose a great many unsuspected infections.
4. This, many times, enables the patient to be referred to the rhinologist earlier with better results from treatment.
5. Follow-up films to determine progress are just as important here as in other conditions.
6. In addition to the treatment by the rhinologist, many cases can be markedly benefited by roentgen therapy.
7. We believe there is a definite field for this method of therapy in carefully selected cases of sinus infections.
8. A whole-hearted and sincere co-operation between the rhinologist, radiologist, and the allergist is absolutely essential if the best results are to be obtained.

- (1) BUTLER, F. E., and WOOLLEY, I. M.: Roentgen Therapy in Chronic Sinusitis. *RADIOLOGY*, 23, 528-537, November, 1934.
- (2) DESJARDINS, A. U.: Radiotherapy for Inflammatory Conditions. *Jour. Am. Med. Assn.*, 96, 401-408, Feb. 7, 1931.
- (3) HANSEL, F. K.: Allergy of the Nose and Paranasal Sinuses. C. V. Mosby Co., St. Louis, 1936.
- (4) HODGES, F. M.: Roentgen Ray in Treatment of Carbuncles and Other Infections. *Am. Jour. Roentgenol. and Rad. Ther.*, 11, 442-445, May, 1924.
- (5) Idem: Roentgen Ray in Treatment of Local Inflammations, Cellulitis and Carbuncles. *Jour. Am. Med. Assn.*, 85, 1292-1294, 1925.
- (6) Idem: Roentgen Ray in Treatment of Certain Localized Infections. *South. Med. Jour.*, 19, 857, 858, 1926.
- (7) Idem: Rationale of Roentgen Therapy in Infections. *South. Med. Jour.*, 23, 259-263, March, 1930.
- (8) Idem: Treatment of Mikulicz's Disease. *South. Med. Jour.*, 28, 205-209, March, 1935.
- (9) HODGES, F. M., and BERGER, R. A.: Roentgen Therapy of Some Infections. *Jour. Am. Med. Assn.*, 107, 1551-1555, Nov. 7, 1936.
- (10) HODGES, F. M.: The Roentgen Ray: Facts and Fiction. *South. Med. Jour.*, 29, 1151-1156, December, 1936.
- (11) Idem: Roentgen Therapy of Infections of the Nasal Accessory Sinuses. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 578-584, April, 1938.
- (12) LAW, F. M.: Nasal Accessory Sinuses Roentgenologically Considered. *Ann. Roentgenol.*, 15, Paul B. Hoeber, Inc., New York, 1933.
- (13) MANGES, W. F.: Roentgen Treatment of Infections of the Antrum and Frontal Sinus. *Am. Jour. Roentgenol. and Rad. Ther.*, 10, 374-377, 1923.
- (14) OSMOND, J. D.: Roentgen Therapy of Chronic Sinusitis in Children. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 102-108, July, 1937.
- (15) RATHBONE, R. R.: Roentgen Therapy of Chronic Sinusitis in Children. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 102-108, July, 1937.
- (16) WATERS, C. A., and FIROR, W. B.: Article read at 1938 meeting of the American Roentgen Ray Society.

THE ROENTGEN TREATMENT OF ACUTE PERITONITIS AND OTHER INFECTIONS WITH MOBILE X-RAY APPARATUS¹

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IN 1928, under pressure of necessity, a case of gas gangrene was treated with the mobile x-ray unit, and recovered. The mobile unit was the ordinary unit designed for mobile diagnostic work in general hospitals and rated below 90 kilovolts.

In the first report (1) on the treatment of gas gangrene with the mobile unit, two cases out of eight died. Both of those dying had trunk involvement. In the six who recovered, the infection was entirely, or to a great extent, limited to the extremities. From the outcome of these cases it was thought that probably the mobile unit did not have sufficient kilovoltage to obtain the necessary depth dose to effect a cure in the trunk cases.

This led to a recommendation for the use of higher voltages in treating deep-seated or trunk infections. Since the maximum kilovoltage obtainable from the mobile unit had been used in treating the two cases which died, it was apparent that in the future cases with trunk involvement must be moved to the x-ray department if they were to be treated successfully, or some apparatus producing a higher kilovoltage must be designed to enable the radiologist to treat at the bedside.

Since no bedside apparatus was available, we started to move these patients to the x-ray department. This was done, on a few occasions, and, as these patients recovered promptly, we felt we were well rewarded for our efforts. In fact, we were

so impressed with the results that we decided to treat other infections in the trunk.

Peritonitis, following acute appendicitis and other intra-abdominal infections, is relatively common and was selected for a trial. The immediate difficulty encountered was that of obtaining the permission of the clinician to move the patient with peritonitis to the x-ray department, and we fully agreed with the clinician that the dangers involved in moving the patient seemed out of proportion to the chances of improving his condition. The whole thing then resolved itself into providing some means of treating the patient with peritonitis without disturbing him in any way, and, as no equipment was commercially available for this purpose, we felt that it was our duty to devise some means of providing x-ray treatment at the bedside, for those who were too sick to be moved.

In a short tour of the local x-ray dealers' basements, we were able to select from the stock of obsolete and discarded x-ray equipment, a suitable transformer which was mounted upon a wooden base carrying a tube stand. We found two such units, and built two mobile units; they have served our purpose very well. They are not, we hope, the last word in this type of equipment, as we appreciate some deficiencies in this assembly, but we look for a real piece of apparatus to be developed in the near future for this type of work, as we are certain that the results will warrant its production.²

¹ Presented before the American Medical Association, Section on Radiology, San Francisco, June, 1938; also read in part before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

² Since this paper was presented at the meeting of the American Medical Association in June, 1938, at San Francisco, some of the x-ray manufacturers in this country have built equipment especially designed for this type of work.

The first two cases of peritonitis treated were cases about which the surgeon was especially anxious. In both of these cases,

the x-ray had nothing to do with the recovery of either, and that it was merely a coincidence that x-ray therapy was started as the patient began to recover. However, the point I am trying to make is that peritonitis is a disease, or a complication, which may take a sudden turn for the better, or for the worse, and nothing concerning the specific curative effect of any single measure, when many remedies are being used on every case, will ever be proven in a short series of cases. Let it be understood, therefore, that we are not attempting to prove anything in this presentation: we are merely relating some experiences in the treatment of 24 cases of peritonitis, and some other acute infectious diseases and complications, at the bedside, with a mobile x-ray therapy unit (Fig. 1). We believe that it has been of definite benefit and recommend that the method be used by others, but we are not interested in attempting to prove it, because of the wide variation in the clinical picture in any series of cases of peritonitis. The criticism which might be advanced against this report, relative to the small number of cases treated, can be answered by referring the critic to the results obtained in the treatment of inflammatory lesions in the regular x-ray department with the stationary type of apparatus for the past quarter of a century.

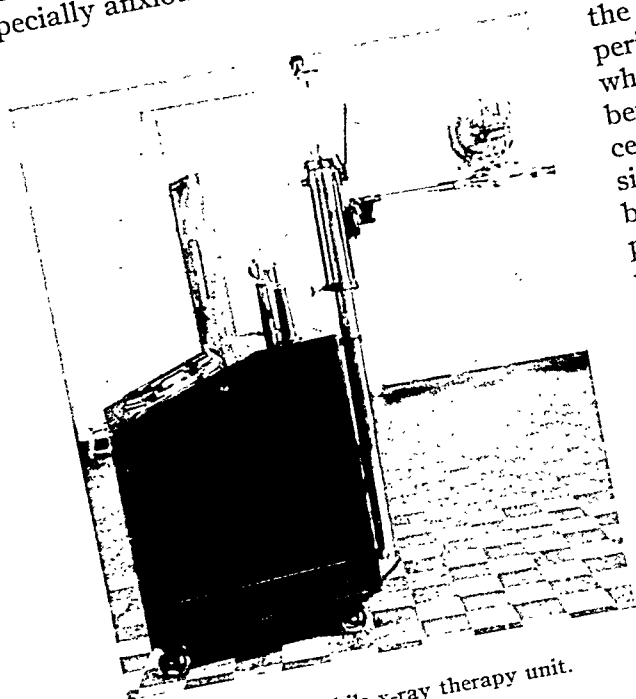


Fig. 1. Mobile x-ray therapy unit.

improvement started promptly with the beginning of the use of the x-ray, and in each instance the surgeon expressed his appreciation of the value of the x-ray in treating his patient. If you wish to make some good friends among your surgical colleagues, become equipped to assist them in their battle to save the lives of such of their patients who come in with ruptured appendices and general peritonitis, and those who, for some unknown reason, develop peritonitis post-operatively, sometimes to the surgeon's surprise and embarrassment.

In presenting this brief paper it would be foolish to attempt to evaluate the exact position of the x-ray in this work. We all realize that many cases of peritonitis, and infections elsewhere, recover quite suddenly after the battle appears lost to the patient. Why such sudden changes take place is frequently not understood by the clinician, and such may have been the situation in the two cases of peritonitis

There can no longer be any doubt as to the efficacy of the method, and the late Dr. Willis Manges pointed out that:

"The effect of the x-ray in treating gas gangrene, which had resisted other direct methods of therapy, was so nearly specific that it established the x-ray indisputably as of value in the treatment of infectious processes. All other infections heretofore treated with x-ray were self-limited or responded to other measures—not so with gas gangrene."

In our opinion, the results obtained in gas gangrene are not any more spectacular than those obtained in surgical mumps, and many of the mixed infections met with in every-day clinical practice. One can only

judge the efficiency of any method of therapy through bedside observation on the individual case. Naturally, there will be a variation in the outcome for statistical purposes, and statistics are too vulnerable and too open to manipulation to be very impressive to the average clinician, who believes for the most part only what he sees. Our advice to all who wish to help the patient who has a localized infectious process and is too sick to be moved to the x-ray department for treatment, is that he should receive treatment with a mobile x-ray unit capable of producing a satisfactory depth dose, and let the clinician be the judge.

Table I shows a list of cases which we have recently treated at the bedside. This table does not include all cases treated at the bedside during the last ten years, but is used to show the type of case in which mobile therapy is indicated.

TABLE I

Diagnosis	Cases Treated	Living	Dead	Mortality
Peritonitis	24	17	7	29
Streptococcic cellulitis	20	20	0	0
Surgical mumps	14	13	1	7.1
Furunculosis	3	3	0	0
Erysipelas	2	2	0	0
Mastoiditis	3	3	0	0
Ludwig's angina	4	4	0	0
Gas gangrene	12	11	1	8.33
Phlebitis	1	1	0	0
Prophylaxis	9	9	0	0
Pneumonia (lobar)	7	7	0	0
Bacteremia	1	0	1	100
Total	100	90	10	10%

Peritonitis.—When following acute appendicitis and other intra-abdominal infections, peritonitis has responded immediately on many occasions. In a few instances, in the cases of peritonitis, it was necessary to treat the chest for secondary involvement and the response when treating over the lungs and pleura or the subphrenic area was prompt and decisive.

In the peritonitis group two patients who died had complete obstructions at postmortem. The x-ray will not free adhesions. Another patient who died in this same group had a large amount of free pus

in the abdomen; the only drainage instituted was a small tube in the *cul de sac*. One must have adequate drainage from all pus-containing cavities. One must be alert to the requirements of each individual case. Some of the acute appendicitis cases received pre- and post-operative treatment and recovered promptly.

No harm came to patients who had pre-operative or post-operative treatment immediately after appendectomies. We are inclined to believe that the small doses we use have no injurious effects and do not interfere with the healing of the incision.

Pneumonia.—We have had opportunity to treat only a few cases of pneumonia, but we are convinced by the prompt response in our cases that Powell's (2) work on the x-ray treatment of this highly fatal disease is going to revolutionize its treatment. A mobile therapy unit with adequate kilovoltage seems essential in this work.

Post-traumatic Prophylaxis.—Some severe injuries, with contaminated wounds, were treated on admission to the hospital, and failed to develop any infection. Some were compound fractures, which united promptly without the development of gas gangrene or even the usual osteomyelitis. Our experience clinically, has led us to believe very strongly that the x-ray may be used for the prevention of gas gangrene. We recommend the routine use of a daily dose of 75 r for the prevention of the onset of a gas infection, but insist that tetanus antitoxin be given to prevent tetanus. This applies to all wounds in which a gas-forming infection is likely to occur, such as compound fractures and other penetrating or severely lacerated wounds.

Staphylococcus and Streptococcus Infections.—The streptococcic cellulitis group respond more readily and remain inactive with greater certainty than do the staphylococcic group. This latter group are more stubborn, require treatment over a longer period of time, and are prone to reactivate on the least provocation. The earlier x-rays are used the more effective they will be. Suppuration may occur, then drainage is indicated. Considerable tissue

adjacent to the infected area should be included in the treatment.
One patient in the staphylococcus group died 20 days after x-ray treatment was discontinued. The infection was then apparently under control, but became active a few days later, and the clinicians failed to request additional x-ray treatments, electing to depend upon general measures, transfusions, and sulfanilamide. Usually,

parently under control, but became active a few days later, and the clinicians failed to request additional x-ray treatments, electing to depend upon general measures, transfusions, and sulfanilamide. Usually,

GRAPHIC CHART

Case No. 1
Dr. L.D. McGuire - AC Johnson

Name Miss M.K.

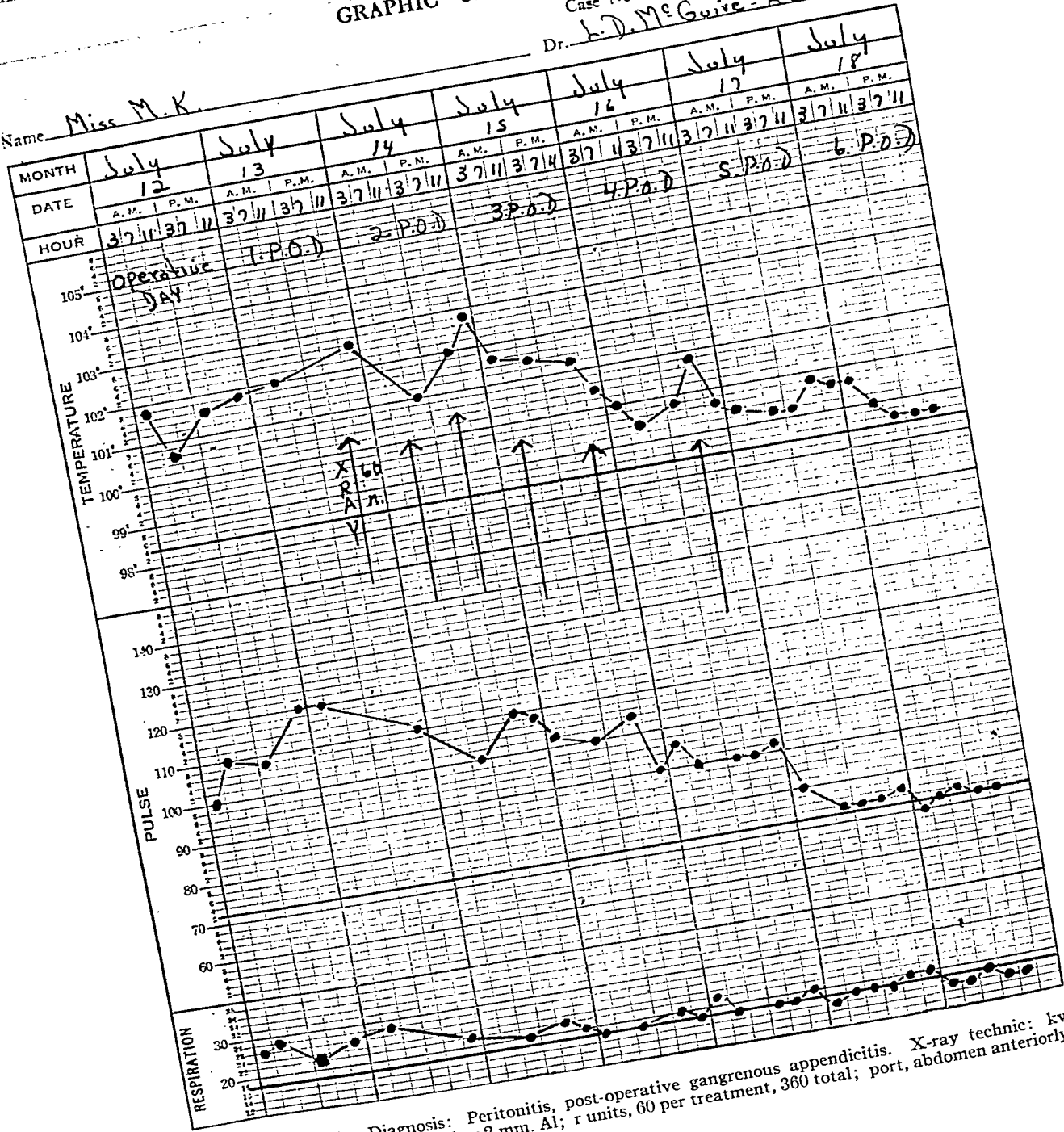


Fig. 2. Case 1. Diagnosis: Peritonitis, post-operative gangrenous appendicitis. X-ray technic: kv. 110; ma. 5; distance 50 cm.; filter 2 mm. Al; r units, 60 per treatment, 360 total; port, abdomen anteriorly; result, excellent.

it is well to continue with a daily treatment for two or three days after the temperature reaches normal, then observe the case for a short time for a possible re-activation of infection.

Ludwig's angina is another serious infection which responded, but less rapidly, to x-ray therapy.

Peritonitis (Recovery).—Case 1. Miss M. K., 16 years of age, was admitted to the hospital on July 21, 1934, with a diagnosis of acute gangrenous appendix. White blood cell count was 19,400, 89 per cent polymorphonuclears. The patient was operated upon immediately. The appendix was greatly distended and gangrenous on the tip, and there was free fluid in the peritoneal cavity. The following day, the diagnosis of general peritonitis was made, and x-ray treatment was started immediately. The patient received one treatment the first day, two on the following two days, and one on the fourth day. The response was prompt and she left the hospital on the eighth post-operative day.

Two features in this case are worthy of note. X-ray treatment was started the next day after operation, the incision healed by primary intention, and the patient left the hospital on the eighth post-operative day. The Wangensteen apparatus and sulfanilamide were not used.

Note in Figure 2 the steady decrease in the pulse rate which seems characteristic of cases treated with x-ray. They seem definitely less toxic quite soon after x-ray treatment is started.

Case 2. T. O. B., male, aged 22 years, rock quarry foreman, was admitted to hospital with a diagnosis of appendicitis on Feb. 7, 1938. He was operated upon immediately after admission and a retrocecal appendix was found. White blood cell count on admission was 18,300, 79 per cent polymorphonuclears. The appendix had perforated at the tip, was acutely inflamed, and there was bloody fluid and free pus in the abdominal cavity. X-ray treatments were started two hours after operation, at 7:30 P.M., and he received two treatments the following day,

one the next day, two the following day, and one the last day. His clinical improvement was very prompt, and at no time did he show evidences of toxicity or abdominal distress, such as is commonly found post-operatively. He had practically no distention. The Wangensteen apparatus was not used at any time and he received no sulfanilamide. He left the hospital on the tenth post-operative day. It is worthy of note that this patient received treatment within two hours after the incision was made and for the following four days thereafter, but healed by primary intention. This fact is reported because many object to the use of the x-ray immediately following operation, fearing that there may be some interference in the union of tissues at the incision. In this series, some cases were treated before and others immediately after operation, with no apparent effect on the operative wound.

Case 3. Mrs. O. S., white, 45 years of age, was admitted to the hospital on April 26, 1937, for pelvic surgery, which was quite extensive. Resulted in the removal of a uterine fibroid, appendix, tubes, and a cystic right ovary. She was operated upon on April 27, 1937, developed a fever immediately after the operation, and steadily became worse, with distention and evidence of peritonitis. On the fifth post-operative day she was extremely sick with a grave prognosis, when x-ray therapy was started. Two treatments were given the first day, two the second day, one the third day, one the fourth day, after which her temperature remained normal.

This patient made a spectacular and impressive recovery. The surgeon expressed his appreciation for the aid given to a patient who appeared to be steadily losing ground under the usual routine treatment of the Wangensteen apparatus, transfusions, and general supportive measures. She received no sulfanilamide.

Comment: This patient was absolutely too sick to be moved to the x-ray department and the mobile x-ray therapy unit seemed beyond a doubt to be the greatest factor in her recovery.

Pneumonia (Recovery).—Case 4. Master D. T., aged six years, was admitted to the hospital on Jan. 15, 1938, with a diagnosis of appendicitis and hernia. His appendix was removed and the hernia re-

paired on the day of admission. Two days later, clinical diagnosis of pneumonia (Type 3) was made. The temperature was 105°, but an x-ray film on Jan. 17, 1938, failed to disclose any evidence of consolidation.

GRAPHIC CHART

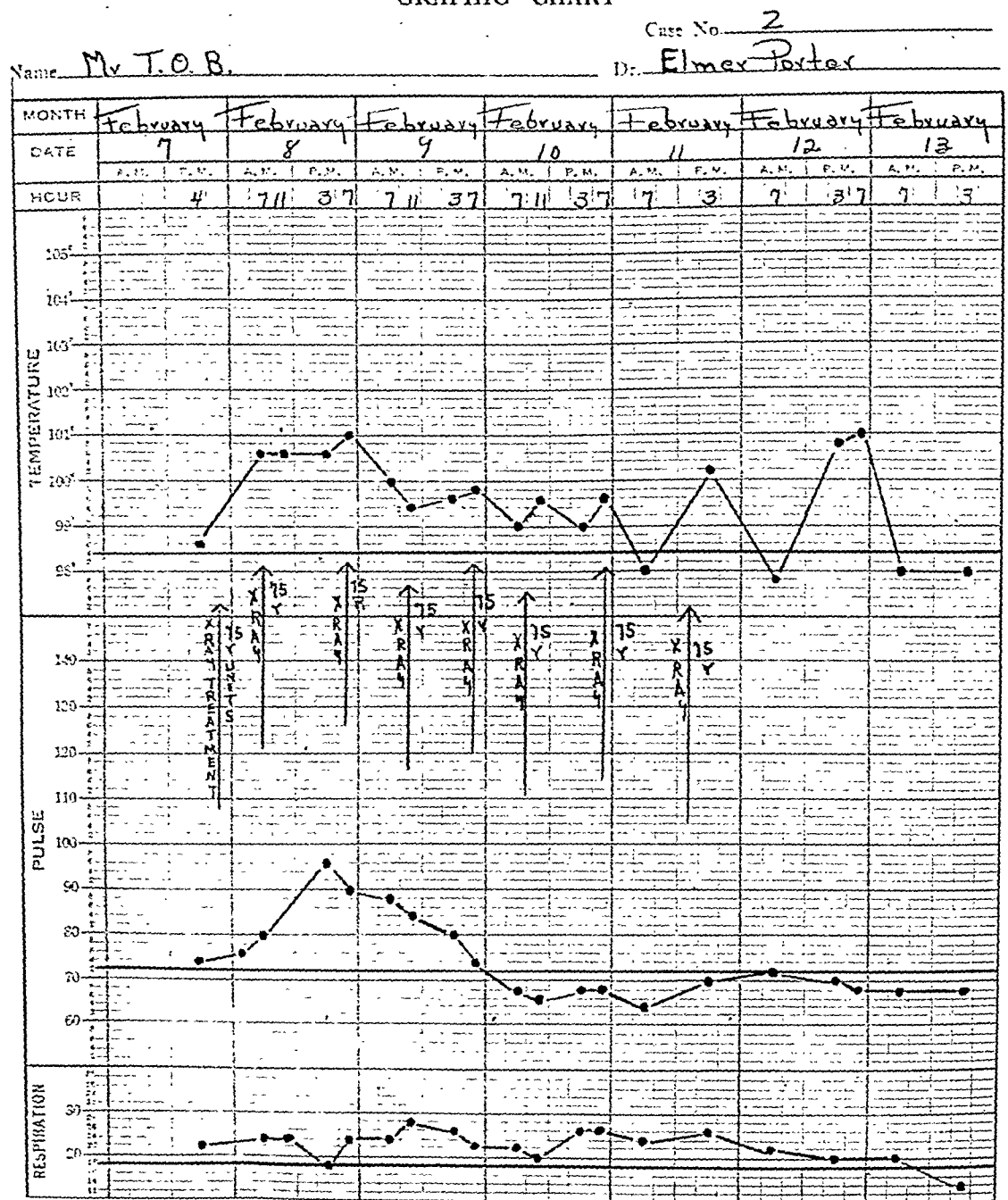


Fig. 3. Case 2. Diagnosis: peritonitis, perforated appendix. X-ray technic: kv. 110; ma. 5; distance 50 cm.; filter 3 mm. Al: r units, 75 per treatment, total 600; port, lower abdomen anteriorly; result, excellent.

However, x-ray treatment was given over the chest at the clinician's request. The patient was also treated the following day. On the day following this, Jan. 19, 1938, a film of the chest disclosed a consolidation

in the upper lobe. The patient again received x-ray treatment, and also one treatment per day for the following two days, making five treatments on five successive days. An x-ray film taken on Jan. 23,

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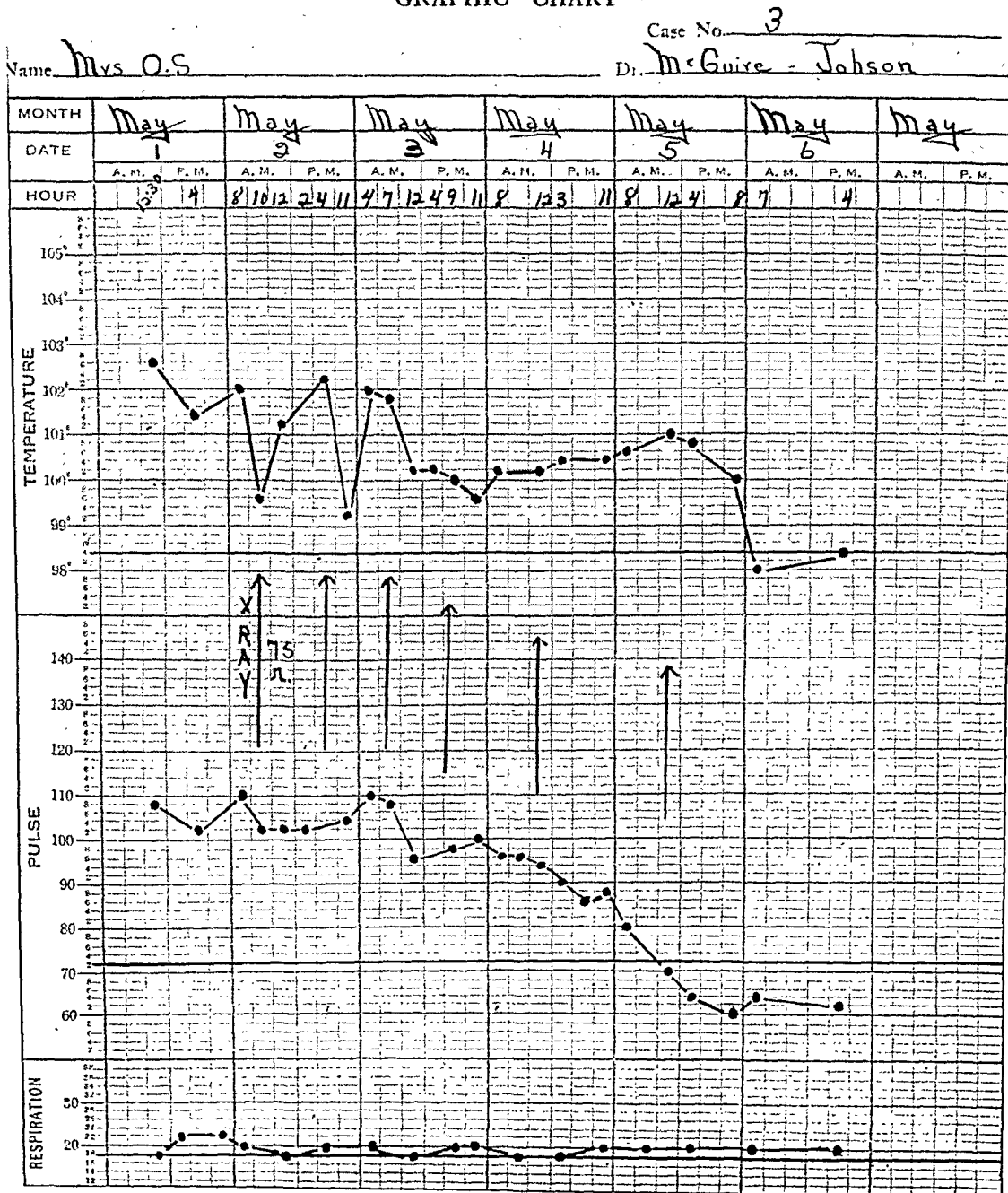


Fig. 4. Case 3. Diagnosis: peritonitis. X-ray technic: 100 kv.; ma. 5; distance 40 cm.; filter 2 mm. Al; r units, 80 per treatment; port, abdomen; result, excellent.



Fig. 5. Case 4. Patient D. T., pneumonia; recovered. Film taken on Jan. 17, 1938.

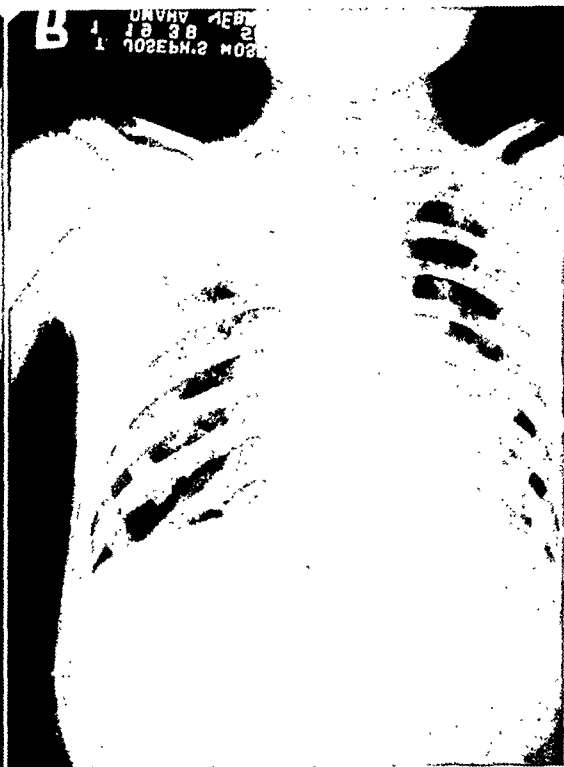


Fig. 6. Case 4. Patient D. T., pneumonia; recovered. Film taken on Jan. 19, 1938.



Fig. 7. Case 4. Patient D. T., pneumonia; recovered. Film taken on Jan. 23, 1938.

1938, showed the pulmonary consolidation in the upper right lung-field to have completely disappeared. The patient was discharged from the hospital on the day the last film was taken.

This case was very interesting in that the patient was diagnosed clinically before the x-ray showed any evidence of consolidation, and was treated once each day for a period of five days. The films showed the lungs clear at the beginning and at the end, the entire period being but seven days. He received no sulfanilamide. He was in the oxygen tent and received daily x-ray treatments, 60 r per day, 400 r units total.

Lobar Pneumonia (Recovery).—Case 5. Miss J. B., eight years of age, was admitted to the hospital on Jan. 30, 1938, at 4:30 P.M., complaining of severe pain in the abdomen and shortness of breath. Her temperature was 104.6°; pulse, 110. She coughed considerably and had a rusty sputum. White blood cell count on admission was 20,300, and the diagnosis was

lobar pneumonia. This diagnosis was confirmed by x-ray films which showed a consolidation in the upper right lobe.

X-ray treatment was started the second day after admission. The temperature

dropped on the third day after admission. She was given six x-ray treatments in all, and left the hospital on the twelfth day. She received no sulfanilamide, no transfusions, no oxygen. She was on a high ca-

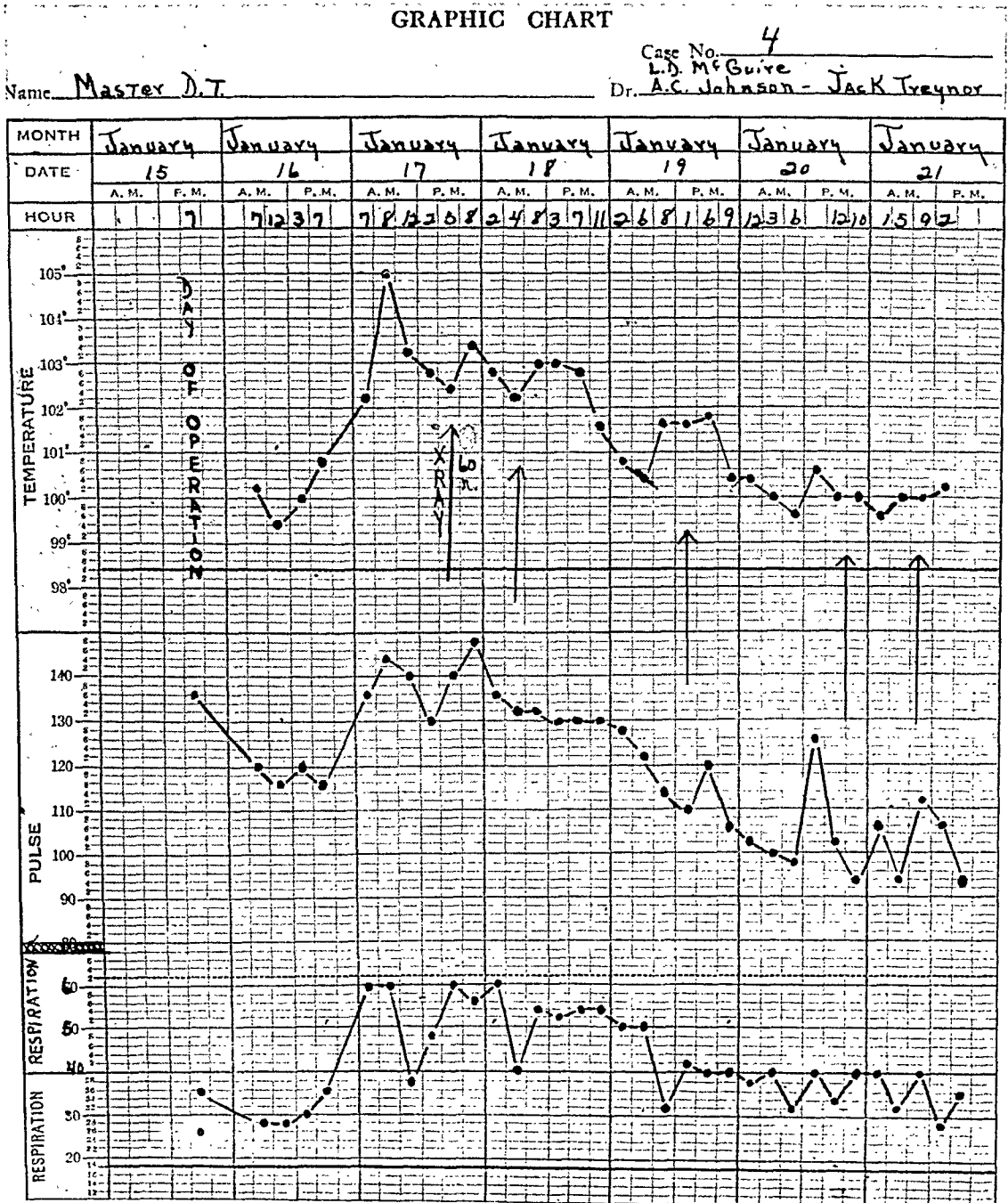


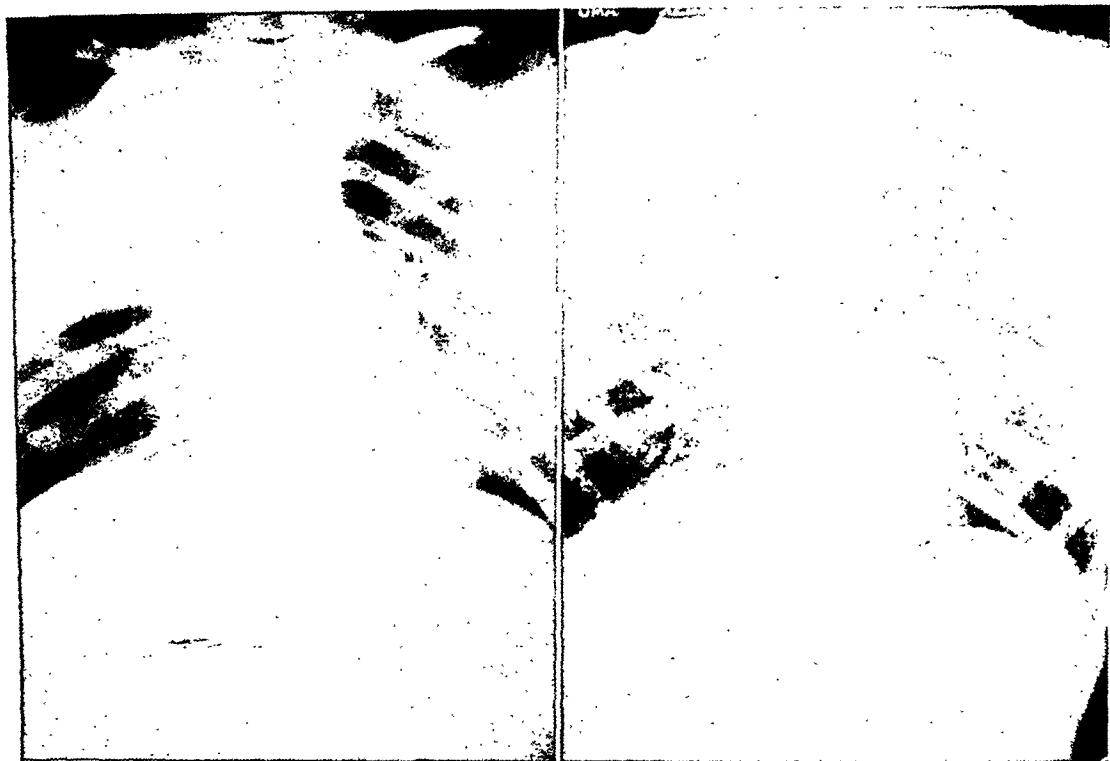
Fig. 8. Case 4. Diagnosis: lobar pneumonia, Type III. X-ray technic: kv. 110; ma. 5; distance 50 cm.; filter 3 mm. Al; r units, 60 per treatment, total 300; port, chest anteriorly; result, excellent.

loric soft diet, had turpentine stupes and colonic irrigations, and was dismissed on Feb. 12, 1938.

Prophylaxis.—Case 6. Mr. G. K., aged 20 years, was admitted to the hospital on Dec. 9, 1938, immediately following compound fracture of left tibia. The

tained, which should encourage those who are timid in the use of x-ray therapy over fracture site, lest non-union result.

We believe one of the most important uses for a mobile unit is the prevention of gas gangrene in compound fractures and similar injuries.



Figs. 9 and 10. Case 5. J. B., eight years of age, lobar pneumonia; recovered.

wound was debrided and scrubbed with tincture of green soap and sterile water, and then closed loosely over a soft rubber drain. A plaster cast dressing was applied, leaving an open window over the site of the external wound. He received one x-ray treatment of 80 r each day for three days, or a total of 240 r. The patient showed no evidence of infection and the wound healed promptly. New bone was also formed rapidly about the ends of the fractured bones and he had a firm bony union which he used for weight-bearing in four months' time. The x-ray films show the character of the union ob-

Surgical Mumps (Recovery).—Case 7 J. H., male medical student, aged 23 years, was admitted to the hospital on March 18, 1938, with acute appendicitis. He was operated upon on the same day. The convalescence was quite stormy, with abscess formation in the left abdominal wall which was drained on April 14, 1938, followed by development of bilateral parotitis, two days after the second operation, on the twenty-ninth hospital day.

Comment: Clinically, the patient had a severe parotitis, but his temperature dropped promptly after x-ray therapy was started. He received two treatments the

first day, two the second day, one the third day, and one the fifth day. A clinician, who as a rule is dubious as to the effect of x-ray treatment as a therapeutic aid, expressed satisfaction with the prompt response to this treatment. The patient received no sulfanilamide.

Cellulitis.—Case 8. J. C., white male, aged 45 years, was admitted to the hospital on March 28, 1938, complaining of pain in the right leg, fever, and chills, of ten days' duration. His temperature was 104°, pulse 102, respirations 22. Blood cell count, 14,800 whites. He gave a his-

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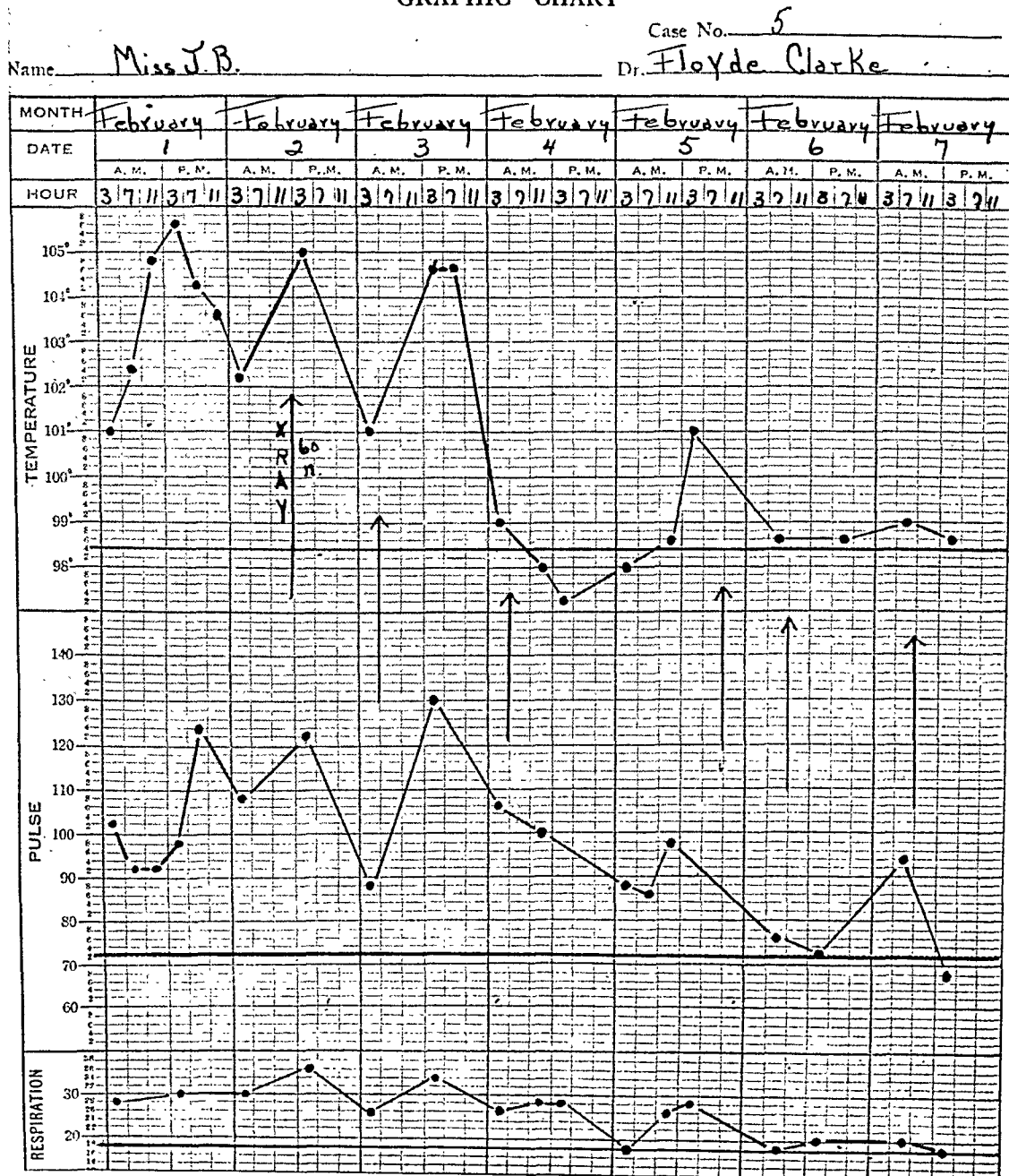


Fig. 11. Case 5. Diagnosis: lobar pneumonia. X-ray technic: kv 110; ma. 5; distance 50 cm.; filter 3 mm. Al; r units, 60 per treatment, total 360; port, entire chest anteriorly; result, excellent.

tory of stepping on a nail which penetrated his foot two weeks before.

Hot packs of magnesium sulphate and x-ray therapy were ordered. The first x-ray treatment was given four hours after

Gas Gangrene (Recovery).—Case 9. Mrs. H. B., negress, 27 years of age, entered County Hospital, on April 20, 1938, with a history of having been struck on the jaw by her husband three days previously. The

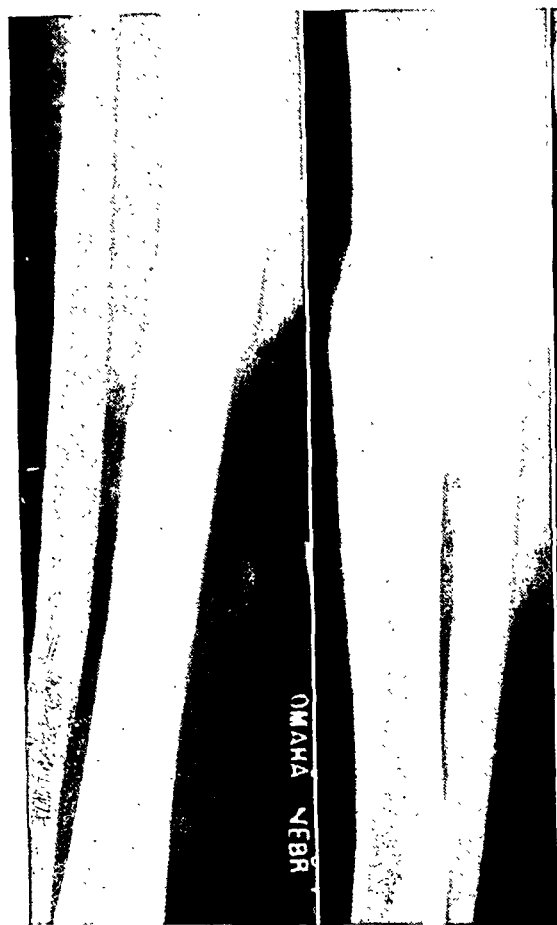


Fig. 12. Case 6.

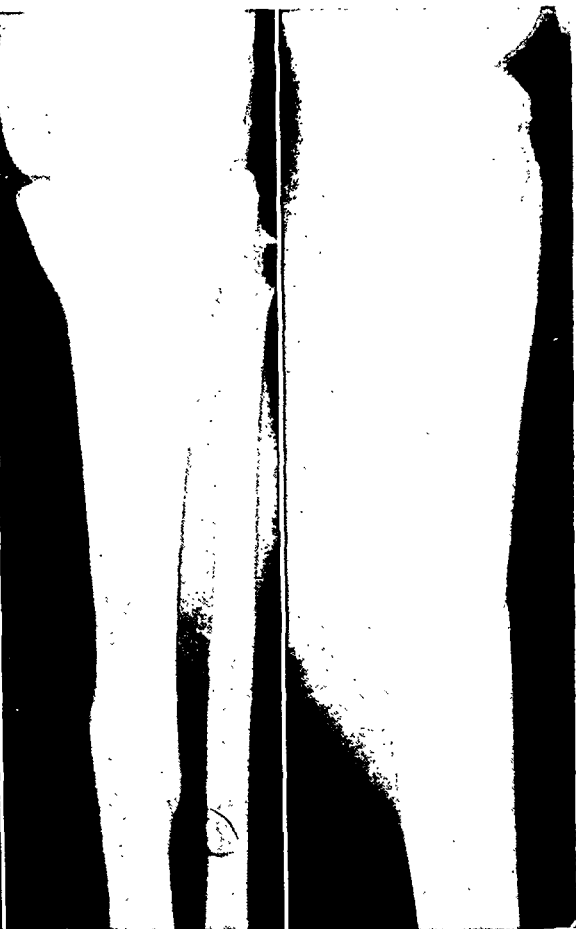


Fig. 13. Case 6.

admission. One treatment was given each day for the following three days; in all, four treatments were given. His temperature began to drop immediately after the first treatment and was normal the last two days of his stay in the hospital. He received no tetanus antitoxin and no sulfanilamide. He returned home and had no further complications.

Comment: The x-ray therapy seemed to be of immediate aid in this case and undoubtedly cut down the period of hospitalization.

first day following the injury the jaw was painful and markedly swollen, but the patient was not especially ill. The second day following the injury, however, the pain increased, the jaw and the side of the neck became markedly swollen and puffy. The patient had severe headache, nausea and vomiting, and five chills during the day, each of which lasted from 15 to 20 minutes. The third day following the injury the patient was taken to the Creighton Dispensary, and from there was immediately sent to the County Hospital, where, on

admission, an x-ray film showed a fracture of the mandible with a large amount of gas in the soft tissues. Blood cell count on admission was 18,000 whites with 61 per cent polymorphonuclears. The Wassermann

test was negative. Incision and drainage was done by Dr. Yechout, on April 21, 1938, and a residual area of pus was drained on May 4, 1938. The patient received nine x-ray treatments.

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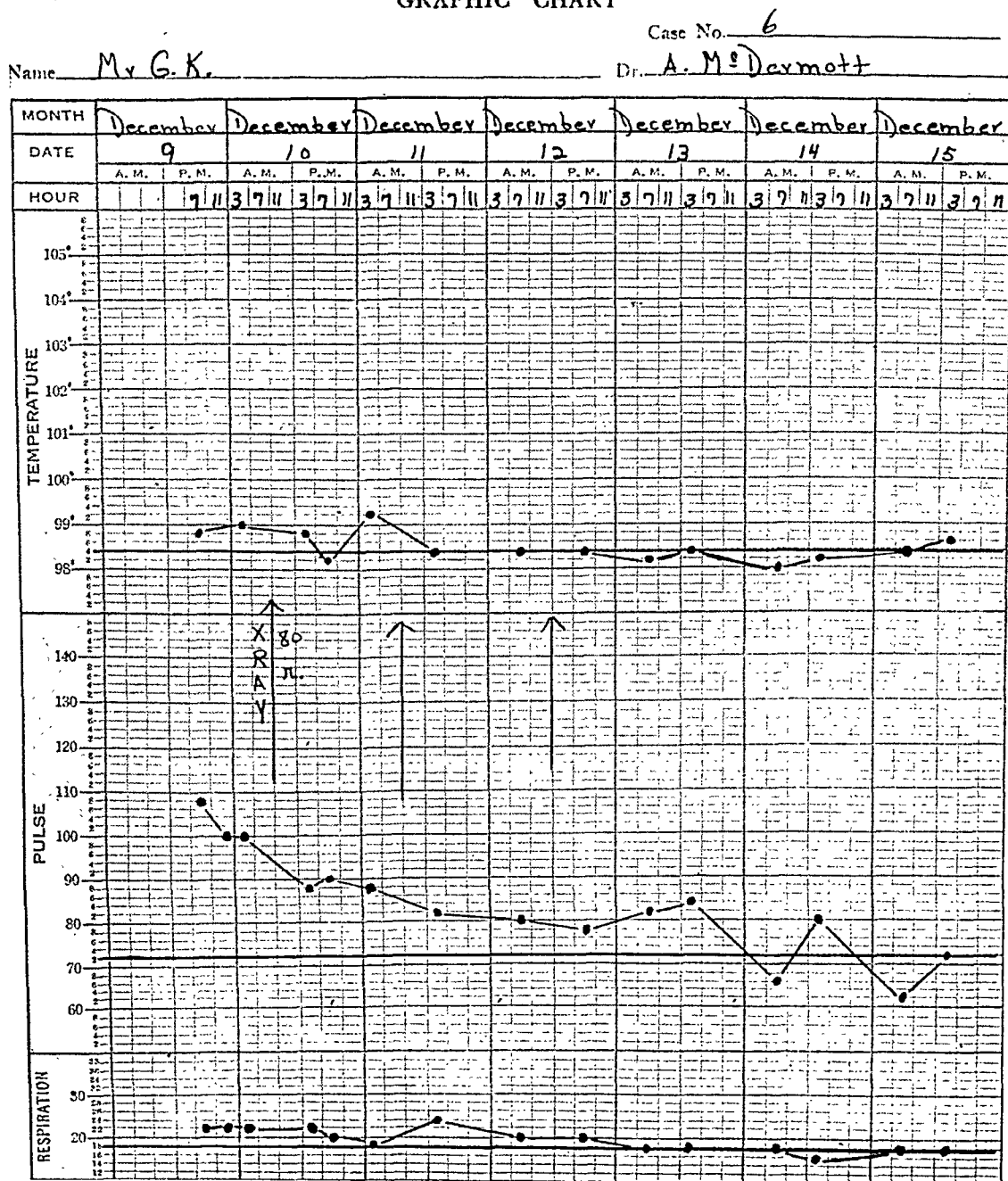


Fig. 14. Case 6. Diagnosis: compound fracture of the right tibia. X-ray technic: kv. 110; ma. 5; distance 50 cm.; filter 3 mm. Al; r units, 80 per treatment, total 240; port, right leg anteriorly only; result, excellent.

It is worth noting in this case that the patient received no gas bacillus serum, no sulfanilamide, conservative surgery, and made a prompt and satisfactory recovery, using the x-ray as the principal therapeutic agent.

ACTION OF X-RAYS

Dr. Desjardins (3), from clinical observations and an extensive review of the experimental and clinical reports on the treatment of inflammations with x-ray, makes the suggestion that white cells prob-

GRAPHIC CHART

Case No. 7
Name Mr. J.H. Dr. F.C. Hill

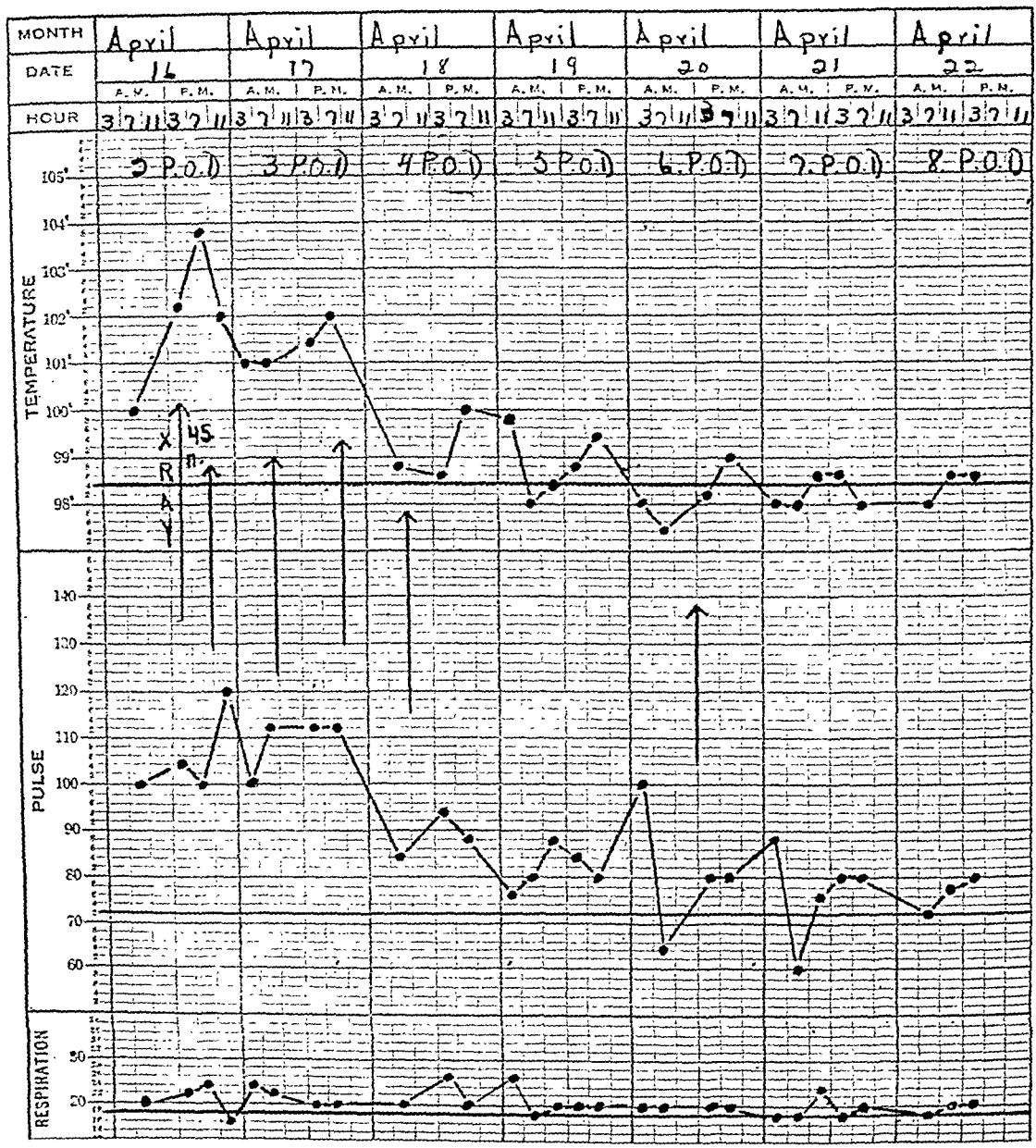


Fig. 15. Case 7. Diagnosis: surgical parotitis. X-ray technic: kv. 110; ma. 5; distance 50 cm.; filter 3 mm. Al; r units, 45 for three treatments and 60 for three treatments, total 315; port, both parotid glands; result, excellent.

ably undergo lysis when radiated and in this lytic process antibodies, or other defense measures, are presumably freed in the infected area. The benefits almost uniformly obtained through treating an infection with x-ray treatment would lead

one to believe that Dr. Desjardins' suggestion as to the effect of the x-ray in treating inflammations is correct. To free these antibodies twice each day seems particularly helpful, in the fast-moving infections.

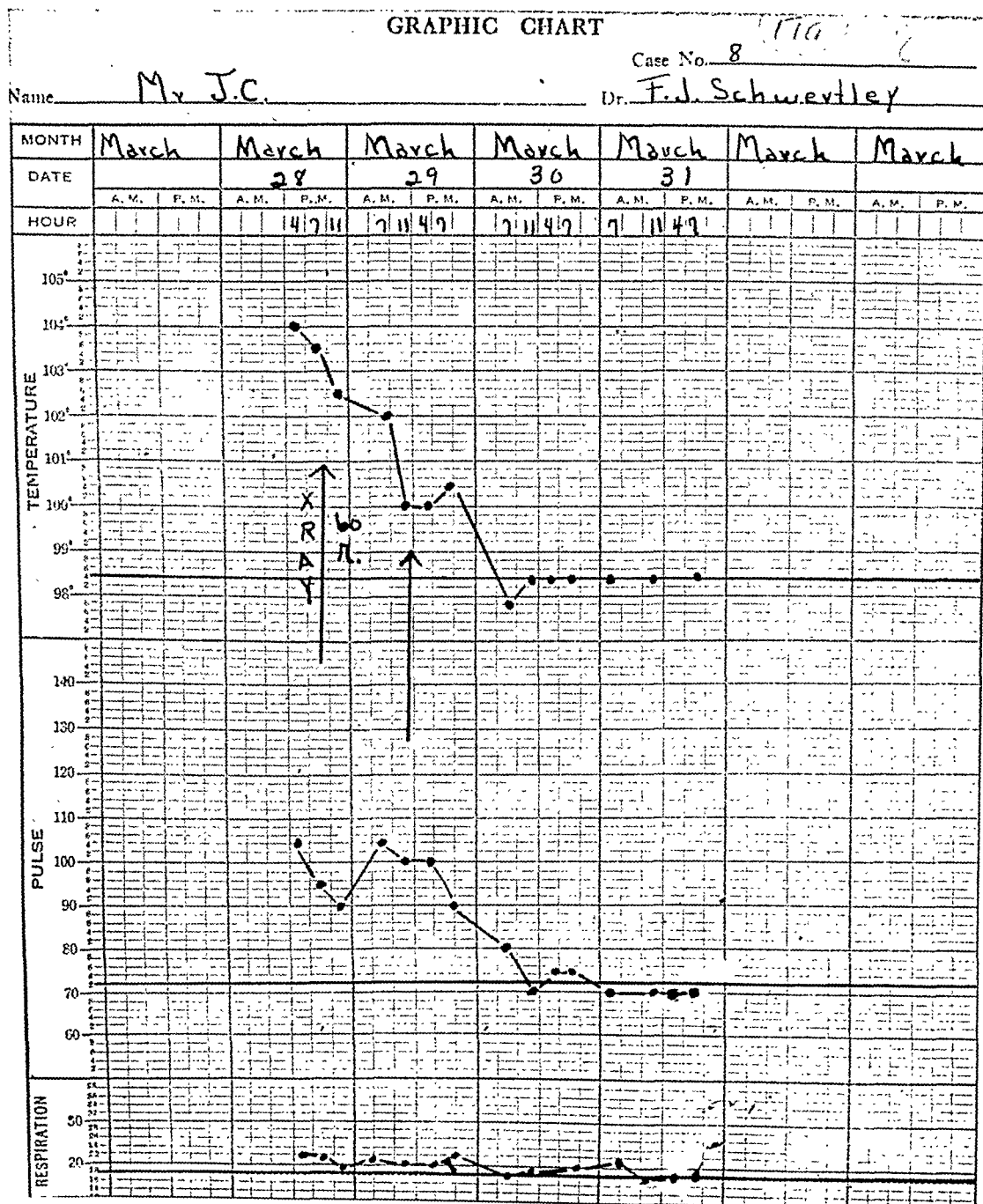


Fig. 16. Case 8. Diagnosis: cellulitis of foot, penetrating wound. X-ray technic: kv. 100; ma. 5; distance 40 cm.; filter 3 mm. Al; r units, 60 per treatment; port, foot and ankle area, one surface; result, excellent.

Regardless of the mode of action, one is soon convinced by the results obtained. We encourage others to treat at the bedside and judge for themselves. In instances in which combined treatment is necessary, as in most of these cases, the clinician is at all times the best judge as to what helps the patient. The x-ray is no miracle worker, it is no cure-all. It is a great aid in treating infections in various locations, is quite universally compatible, and should be used in conjunction with all the safe measures usually employed in treating the conditions.

INDICATIONS FOR X-RAY TREATMENT

1. In local infections which—
 - (a) are likely to spread to adjacent tissues;
 - (b) may develop complications in some distant organs;
 - (c) are likely to destroy large areas of tissue;
 - (d) are associated with severe toxemia;
 - (e) have apparently become stationary with no evidence of repair.
2. As a prophylactic measure in contaminated wounds to prevent infection from becoming established (compound fractures).
3. In bacteremia: There is no contra-indication to the treatment of a local area of infection from which a bacteremia had its beginning, but in our experience we have not been able to determine whether or not any good has been accomplished by such treatment.
4. In general, in cases in which infection is present, x-ray therapy is indicated, pre-operatively and post-operatively.
5. Finally, do not depend upon x-ray therapy to prevent tetanus; use anti-toxin.

DANGERS

Wherever the x-ray is used some danger is present. This has been recognized for a great many years. X-ray treatments

should be prescribed only by a radiologist. Dangers are acute radiation effects, chronic or slow radiation effects, and electrical shock. X-ray treatments should be given only by a radiologist or a trained technician under the direct supervision of a radiologist; others may have trouble.

CONTRA-INDICATIONS

If the treatments are given under the direction of an experienced radiologist, there are no absolute contra-indications. Repeated small doses of from 50 to 70 r morning, and of from 50 to 70 r evening, for from three to five days during the height of the infection, are recommended. The correct technical factors must be prescribed by the radiologist so that the total dosage given is under the minimum which might damage the skin. This is a clinical problem and the radiologist is responsible. Not every patient treated with x-ray therapy will get well, but in no instance has any harm, known or suspected, come to any patient receiving treatment. Some filter should always be used.

X-RAY TECHNIC

(a) Kilovoltage: Sufficient to thoroughly penetrate the involved area; varies from 90 to 135 kv.

(b) Time and milliamperage: From 60 to 100 r units each treatment through each port; dosage should vary depending on size of the port. A smaller dose may be used on the third or fourth day of the disease; 50 r units are probably sufficient for late treatments. Sub-acute cases must be treated an indefinite time so smaller doses are advised.

(c) Ports: Sufficient to cover all involved tissues and adjacent suspected area.

(d) Distance: Fifteen inches (40 cm.).

(e) Filter: No harm has come from unfiltered therapy but we believe it to be dangerous, and it is not recommended as recoveries have occurred with rather heavy (0.5 mm. Cu) filtration. It is recommended that some filter be used; the ab-

sence of filtration may be a legitimate criticism of this procedure and we are opposed to its omission.

(f) Space factor: The reason for treating twice each day, which we insist upon, is based upon the observation that the re-

sults, in the treatment of infections, were better when the space factor or time between treatments approximately coincided with the rate of growth (on culture media or by clinical estimation) of the etiologic organism.

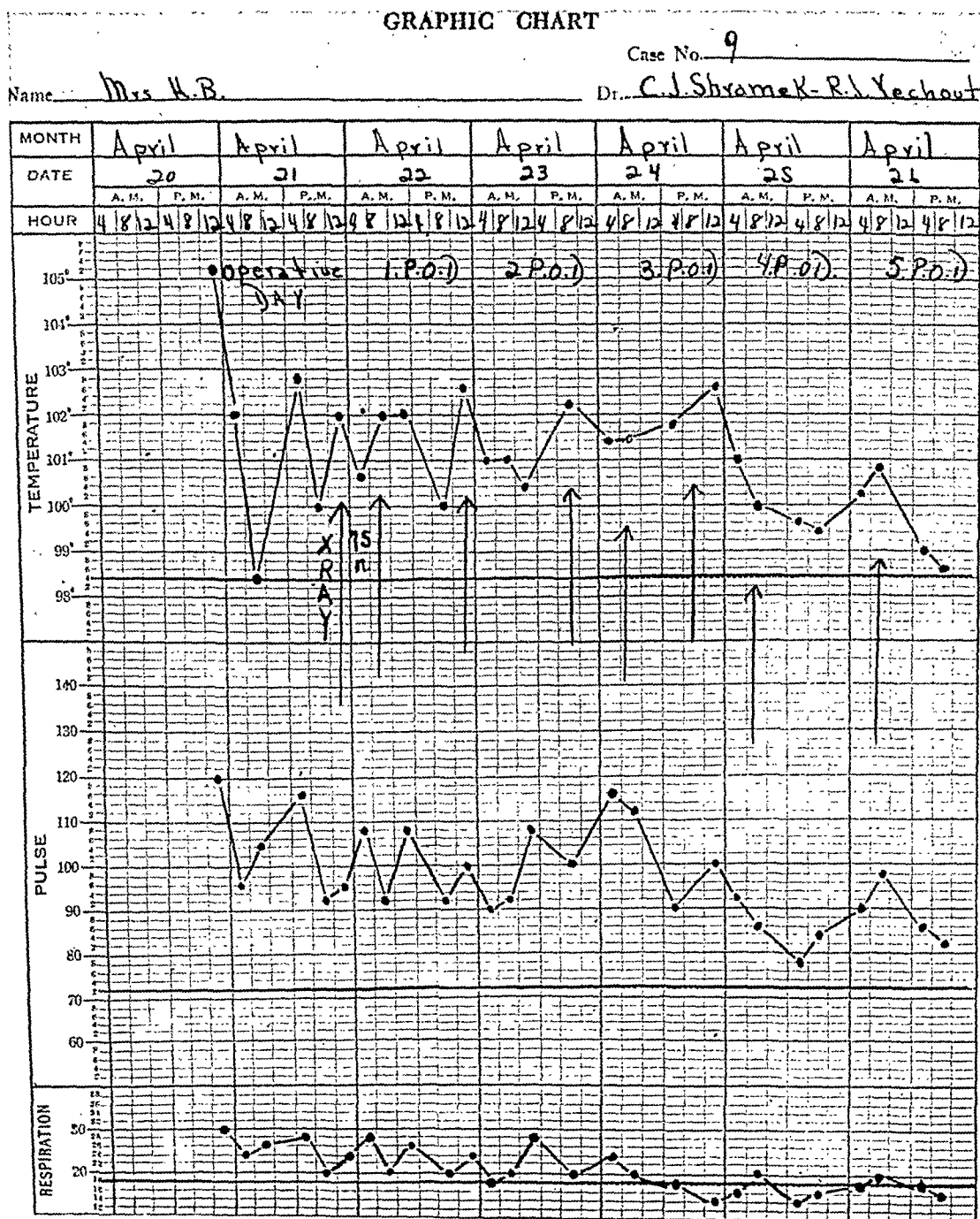


Fig. 17. Case 9. Diagnosis: gas gangrene complicating fractured mandible. X-ray technic: kv. 110; ma. 5; distance 40 cm.; filter 1 mm. Al; r units, 75 per treatment, 675 total; port, left side face and neck; result, excellent.

ADDITIONAL MEASURES

We have the greatest respect for the value of the Wangensteen suction apparatus. We believe this to be an indispensable aid in the treatment of many of these cases, but feel that the use of the x-ray will definitely shorten the length of time the suction apparatus is in use, and, in some instances in which x-ray therapy is started early, the use of the tube is not required.

The use of the oxygen tent is another therapeutic development which has undoubtedly saved many lives.

Blood transfusions have also appeared to be the deciding factor in other cases.

Small doses of sulfanilamide are still an uncertain element, but large doses, following which the patient becomes cyanosed, have, in our opinion, been definitely inhibitory to any beneficial effect the x-ray may produce. As a general rule, in the usual case, we get at least a temporary improvement following radiation therapy, slowing of the pulse probably being the most evident, but in those cases which have been saturated with sulfanilamide before any x-ray treatments are given, we have failed to note even the slightest improvement following the use of the x-ray. Whether the anoxemia, or other blood changes associated in the sulfanilamide-cyanosed patient, prevents any effect from the x-ray or not cannot be stated definitely at this time, but we prefer to treat the patient without the aid of large doses of sulfanilamide.

CONCLUSIONS

This material is merely presented to make available to others who are inter-

ested, some clinical facts which we have observed while treating patients with a bedside therapy x-ray apparatus. Practically all of these lesions, with the exception of gas gangrene, may or may not recover when very little is done for them, so nothing can be proven by any series of statistics; cases observed clinically are convincing. As data accumulate relative to the use of the mobile x-ray therapy apparatus, undoubtedly much improvement in technical procedures will result. At the present time we have outlined, in a general way, the technic we have used in treating numerous infections in patients whom we thought it advisable to treat without moving to the x-ray department. This is done in the interest of the patient who is too sick to be moved, or is held fast in a room by the oxygen tent, the Wangensteen apparatus, or intravenous apparatus, all of which are commonly used essentials in treating the seriously sick. We believe that the x-ray is an additional aid in treating some of these patients and that it can be brought to the patient in the form of a mobile unit, having greater kilovoltage than the present-day diagnostic (90 kv.) mobile unit.

BIBLIOGRAPHY

- (1) KELLY, J. F.: The X-ray as an Aid in the Treatment of Gas Gangrene. *RADIOLOGY*, 20, 296-304, April, 1933.
- (2) POWELL, EUGENE V.: The Roentgen Therapy of Lobar Pneumonia. *Jour. Am. Med. Assn.*, 110, 19-22, Jan. 1, 1938.
- (3) DESJARDINS, A. U.: Radiotherapy. *Jour. Am. Med. Assn.*, 105, 2064-2071, Dec. 21; 2153-2161, Dec. 28, 1935.
- (4) KELLY, J. F.: The Present Status of the X-ray as an Aid in the Treatment of Gas Gangrene. *RADIOLOGY*, 26, 41-44, January, 1936.
- (5) KELLY, J. F., and DOWELL, D. A.: The Present Status of the X-ray in the Treatment of Gas Gangrene. *Jour. Am. Med. Assn.*, 107, 1114-1118, Oct. 3, 1936.

FURTHER EXPERIENCE WITH ROENTGEN THERAPY FOR BRONCHIECTASIS¹

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IN A previous paper we reported the successful use of roentgen therapy in the treatment of chronic suppurative bronchiectasis (11), and the present communication is a report of our further experience in the treatment of this disease.

Rationale of the Use of Roentgen Therapy for Chronic Bronchiectasis.—Although it seemed that early investigators of the action of roentgen rays on various organs reported that the lungs were relatively invulnerable to the action of the rays, the recent introduction of apparatus capable of delivering shorter wave length and larger depth doses has demonstrated that, within certain limits, definite tissue reactions can be produced in the lungs and pleural cavities (6). It was the thought that an analogy might be drawn between the salivary glands and the bronchial mucous glands in their reaction to roentgen rays that led primarily to this work on their use in bronchiectasis. Exposure of the salivary glands to roentgen rays brings about a diminution verging upon abolition of secretion. It was thought that if a comparable reaction could be induced in the bronchial mucosa of bronchiectatic areas, a comparable diminution of secretion and hence expectoration might be expected. However, that such an effect can be produced in the bronchial mucosa of human beings, although supported by some experimental work on animals, is problematical and perhaps unlikely (2). Further explanatory hypotheses may be adduced to explain the successful action of roentgen rays in suppurative bronchiectasis; such as, possible enhancement of immunity processes both through the action of the rays in stimulating antibody action, and the physico-chemical alterations of the local tissue reactions. It is,

perhaps, most logical to assume that the results we have obtained in chronic suppurative bronchiectasis, so far as our present knowledge of the known reaction of tissues to roentgen rays can teach us, are due to the action of roentgen rays on chronic inflammatory processes (5).

Clinical Application of Roentgen Therapy.—Based upon the above outlined concepts of the action of roentgen radiation upon the chronic inflammatory bronchial and peribronchial lesions and upon the mucus-secreting bronchial epithelium, roentgen therapy was instituted in a series of cases of chronic suppurative bronchiectasis (1). No acute case or cases with recent onset were treated, because it is of considerable importance to be certain that a patient is not suffering from an ordinary superimposed acute upper respiratory infection, which is making otherwise "dry" dilations "wet." It is well known that bronchiectasis may be characterized by spontaneous remissions and exacerbations with seasonal variations. Therefore, all the patients subjected to treatment were previously observed over a period of many months, at least, and were known to have a chronic lesion with sustained high level of expectoration without marked spontaneous remissions. All the patients were thoroughly investigated by means of bronchography and bronchoscopy and the unequivocal diagnosis of chronic suppurative bronchiectasis was thereby clearly established (3, 4).

Diagnosis of Bronchiectasis.—It is of great importance to point out that chronic bronchiectasis is a diagnosis of exclusion. The term "bronchiectasis," unless qualified, means a state of the bronchi—not a disease in the strict sense of the word. The diagnosis of bronchiectasis must be considered as incomplete and inaccurate unless one is able to diagnose the location of the

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

disease, *i.e.*, what lobe or lobes are involved and the size and distribution of the dilations. But of paramount importance is the necessity to ascertain the presence or absence of various local features, such as pulmonary tuberculosis, pulmonary abscess, bronchial foreign body, bronchial adenoma, and bronchial carcinoma. The diagnosis cannot be made upon the clinical history alone, suggestive as it may be. A clinical picture suggestive of bronchiectasis must always be substantiated by bronchography and bronchoscopy. The bronchogram must be bilateral and map out the main branches on both sides. Bronchoscopy must enable one to rule out the presence of foreign body and newgrowth. It is of great therapeutic importance, from our standpoint, to observe which bronchi are discharging and are the sources of expectoration. This should be done *immediately* prior to treatment, in order that a diseased lobe of recent onset be not overlooked.

The majority of the patients had been variously and unsuccessfully treated by bronchoscopic drainage and lavage, pneumothorax, phrenic nerve interruption, and climato-therapy. They were treated by roentgen therapy as a last resort. The alternative in these patients was radical operative intervention, such as lobectomy or pneumonectomy (7).

Classification of Bronchiectasis.—Group

1. The first group would comprise those patients whose clinical symptoms suggest only an aggravated form of chronic bronchitis with superadded catarrhal infection. The clinical course is benign, suppuration is not noticeable, the patients suffer only from cough with variable amounts of mucoid or purulent sputum, febrile episodes are rare, pneumonitis and hemoptysis are absent or very infrequent. The only clinical complaints are cough and expectoration. These patients have rarely required hospitalization and have carried on ordinary activity fairly well for long periods of time. Seasonal variations are marked and disablement is rare. The expectoration may have marked remissions, with periods of entire freedom from symptoms. The ques-

tion here to be resolved is one of prognosis. The possibility of serious progression of infection in catarrhal processes is known to be slight unless there is a superadded attack of pneumonia. Foul suppurative bronchiectasis most often arises in a lung damaged by an attack of true pneumonitis, rarely as a progression of the lesions in a catarrhal process. Lobectomy done for this type of catarrhal lesion will show a very low mortality. The only justification for lobectomy for this type of lesion is the assumption that these patients are due to progress, within a few years, to the more severe forms of infection. The validity of this assumption is to be questioned, inasmuch as our present evidence goes to show that this sequence has not arisen, but rather that the definitely suppurative type of bronchiectasis most often arises in a lung damaged by pneumonitis with failure of the lesion to resolve. To recapitulate this argument, one must state that lobectomy for this type of lesion, although showing a low mortality rate, is not the mortality rate for suppurative bronchiectasis, and further, that lobectomy for this type of lesion as a prophylactic measure rests upon an exceedingly questionable assumption that the catarrhal form of bronchiectasis usually progresses to the severe forms of infection (8).

Group 2. In a second grouping of bronchiectasis would be placed those patients who are obviously suffering from a severe chronic infection. The sputum is profuse and abhorrently fetid; cough is harassing and always productive; episodes of fever and pneumonitis with progression of symptoms are common; clubbing of the digits is marked; hemoptyses not unusual, and disablement from activity is the rule. Bronchography reveals cylindrical, fusiform, and saccular dilatations, and x-ray examination shows marked signs of parenchymal involvement. The lung in these grave conditions is a sort of foul sponge, draining pus constantly, with constant systemic absorption of toxins causing severe deterioration of general health. The condition is usually multilobar and not un-

commonly bilateral. The mortality rate of lobectomy in these cases is high and the operative prognosis very grave (8). These cases, however, offer an almost hopeless prognosis under medical treatment, inasmuch as the disease is prone to spread to other parts of the lung. It has been reported that a group of such cases under medical treatment revealed a "medical mortality" of 51 per cent when observed during a period of six years (9). These patients have come to the surgeon finally, in desperation, ready to take any risk to attempt to rid themselves of their disease. The mortality rate of lobectomy in these cases, although not as high as in previous years, is still very formidable. Obviously, a statistical statement of lobectomy mortality rate for catarrhal bronchiectasis is not to be accepted as the rate for this condition.

Group 3. In a third group, one places those patients who occupy the middle ground between the first and second classes. As surgical risks they are neither very good, as in the first group, nor very bad, as in the second group. Cough is serious and distressing but the sputum, though at times foul-smelling, is not continuously so, and is not so profuse. They do not present so toxic an appearance and are usually not totally incapacitated for work. Lipiodol bronchography reveals marked and extensive dilatations but the parenchymal involvement on x-ray examination is not nearly so marked as in the second group. Fever and episodes of pneumonitis are occasional. These patients may present a clinical picture of the same degree of infection and the same symptoms for a period of years without marked progression. However, in general these patients almost inevitably progress to the more severe form of the disease (that of the second group) with recurrent parenchymal involvement and spread to other lobes. Episodes of pneumonitis, when they occur, usually signalize increased intensity of symptoms and a progressive deterioration of general conditions. It is rather difficult to distinguish this group from the second group ex-

cept on the basis of comparative mildness of the degree of anærobic suppurative infection. In this group would be placed those cases of chronic suppurative bronchiectasis secondary to chronic lung abscess which have been operated upon. In these cases the lung abscess has been drained; a bronchocutaneous fistula (single or multiple) is present, cough and expectoration are present, accompanied by fistula drainage in moderate to profuse amounts of the same mucopurulent material. We have treated a series of these cases, referred to us from the thoracic surgical service of Dr. Harold Neuhof, at Mount Sinai Hospital, with the results as appended in the tables of statistics (Tables I-III). It is a justifiable assumption that the outlook in this type is grave, and active measures must be instituted for therapy. Lobectomy in this type of condition

TABLE I.—NON-FOUL CATARRHAL BRONCHIECTASIS

	No.	Percentage
Greatly improved.....	3	60
Moderately improved.....	1	20
Unimproved.....	1	20
	<u>5</u>	

TABLE II.—FOUL SUPPURATIVE BRONCHIECTASIS SECONDARY TO CHRONIC LUNG ABSCESS (OPERATED UPON)

	No.	Percentage
Greatly improved.....	10	50
Moderately improved.....	1	5
Unimproved.....	7	35
Deaths.....	2	10
	<u>20</u>	

TABLE III.—FOUL SUPPURATIVE BRONCHIECTASIS²

	No.	Percentage
Greatly improved.....	18	45
Moderately improved.....	7	17.5
Unimproved.....	7	17.5
Deaths.....	8	20
	<u>40</u>	

² These patients with bronchiectasis and profuse expectoration of large quantities of foul expectoration, although the most seriously ill, have experienced the most benefit and have shown the most striking results and remarkable improvements. In some of these patients, the bronchiectasis involved an entire hemithorax from apex to base, and in some the lesion was bilateral.

(Note continued on next page.)

presents a lower mortality rate than in the second group, but has a mortality rate, nevertheless, which is considerably more than that for catarrhal bronchiectasis.

Comment on Classification.—It is clear, in this discussion of the types of bronchiectasis, that the prognosis under medical treatment and the prognosis of cases selected for lobectomy depend entirely upon the type of pathologic lesion present in any given case. To reiterate, to ascertain the value of competing methods, it is fundamentally necessary to have exact information as to the type of case under consideration.

Method of Treatment by Roentgen Therapy.—To secure "control" to the effect of the treatment, absolutely no other form of therapy was used coincidentally. The patients were treated ambulatorily, for the most part, reporting to the Radiotherapy Department as "out-patients." Roentgen therapy was given to these patients over a period of approximately three months, cross-firing all the diseased and secreting lobes (as revealed by thorough bronchography and bronchoscopy) through anterior, lateral, and posterior fields, utilizing three portals for one lobe, or five for the hemithorax, as necessary. The average total dose used was approximately 1,500 r (international units measured in air) through *each* portal of entry. The physical factors of the technic are as follows: from 180 to 200 kv.; focal skin distance, 50 cm.; filter, 0.5 mm. Cu + 1.0 mm. Al; size of the field, 10 × 15 cm. (average). Each treatment consisted of 75 r measured in air to two or three fields.

The patients were usually treated two or three times a week. It was found that at

Reductions in daily expectoration from as high as 30 ounces to one and one-half ounces have been accomplished, with complete loss of foul odor. Cough, previously harassing, has been abolished or reduced to a short morning bout with an expectoration of approximately one ounce. Concomitant with their great symptomatic improvement, some of these patients have lost the clubbing of their fingers. The episodes of pneumonitis have not recurred. Gain in weight and great improvement in color and energy have occurred with the striking clinical improvement of the chronic constitutional septic state.

least four months must be allowed to elapse, after a course of therapy had been given, to secure the full measure of improvement. In bilateral cases, it is of advantage to treat both sides simultaneously.

Comment on Results.—The improvement that has been obtained in chronic suppurative bronchiectasis, as the result of roentgen therapy, while moderate in some instances, has been so striking and remarkable in others as to render patients practically cough- and sputum-free.

It is perhaps necessary to emphasize here that the only criterion of improvement that we have employed is decrease in expectoration. It is the sole intention of the therapy to render a secreting "wet" bronchiectasis "dry"; *i.e.*, to secure a symptomatic clinical cessation of the main presenting features of the disease; namely, expectoration and cough. The patients who have obtained great improvement in expectoration and cough and who had experienced hemoptyses and episodes of pneumonitis in the past, have been free of these attacks and episodes subsequent to treatment. Small hemoptyses, such as occur in dry bronchiectasis, have persisted in a few of our greatly improved patients. Clubbing of the digits has subsided surprisingly in a number of cases that have been improved. The mechanism of this is not clear, but subsidence and practical disappearance of the clubbing has been the rule in those patients who have been greatly improved by being freed of the inflammatory symptoms of expectoration and cough. These patients still possess their dilated bronchi, but in being rid of their infection they have reversed the process which brought about the clubbing.

Those patients who have responded well to roentgen therapy, whom we classify as greatly improved, have sustained their improvement during the entire follow-up examination to date—in some cases consisting of a period of over six years. During this period of time, upper respiratory infections have been experienced repeatedly in this group and have been characterized by slight increase in odorless expectoration,

but without recurrence of harassing cough and profuse foul expectoration.

Follow-up Examination.—The follow-up examination in the greatly improved cases has revealed, thus far, no recurrence in profuse expectoration with repeated upper respiratory infections, and no tendency to resume foul expectoration. These patients who have responded markedly to roentgen therapy are no longer an abhorrence to themselves and others. They appear clinically quite well, arrested to all practical purposes of their previous symptoms. Several of the most severe cases that have experienced great improvement (from 16 to 20 ounces of expectoration reduced to one ounce) have been, as above noted, followed for over six years without recurrence. No cases herein reported are of less than one year follow-up observation. All of our patients have been followed personally and have been examined at frequent intervals.

COMMENT

The prognosis of bronchiectasis is dependent upon the severity of the infection. The mortality of any therapy for bronchiectasis will vary with the degree of suppuration of the involved lobe. Roentgen therapy employed in severe suppurative bronchiectasis, in which lobectomy has a formidable mortality, has produced favorable results in rendering a large percentage of patients clinically arrested (some observed for at least six years) of the symptoms of chronic toxicity, foul expectoration, and cough.

CONCLUSIONS

1. Roentgen therapy in moderate dosage as the sole method of treatment for chronic suppurative bronchiectasis is feasible and successful, resulting in symptomatic improvement in a considerable proportion of cases.

2. The clinical improvement in chronic suppurative bronchiectasis treated with moderately high dosage of roentgen therapy may be so great in some cases as to approach a practically complete cessation of the symptoms of expectoration and

cough. These patients now appear clinically well and arrested of their previous symptoms of suppurative bronchiectasis.

3. Follow-up examination, over a period in some instances of six years, in those cases that have been improved has shown no recurrence of symptoms with upper respiratory infections.

BIBLIOGRAPHY

- (1) BERCK, M.: Radiotherapy for Bronchorrhea in Bronchiectasis. *Jour. Mt. Sinai Hosp.*, 1, 98-100, July-August, 1934.

- (2) DESJARDINS, A. U.: Action of Roentgen Rays and Radium on the Heart and Lungs: Experimental Data and Clinical Radiotherapy. *Am. Jour. Roentgenol. and Rad. Ther.*, 27, 149, January; 303, February; 477, March; 28, 127, July; 271, August; 421, September; 567, October; 699, November, 1932.

- (3) BALLON, D. H., and BALLON, H. C.: Diagnosis of Bronchiectasis. *Acta Oto-laryngol.*, 2, 580, 1927.

- (4) SICARD, J. A., and FORESTIER, J.: Methode Generale d'Exploration Radiologique par l'Huile Iodee. *Bull. et mém. Soc. med. d. hôp. de Paris*, 46, 463, March 17, 1922.

- (5) DESJARDINS, A. U.: Radiotherapy for Inflammatory Conditions. *Jour. Am. Med. Assn.*, 96, 401-408, Feb. 7, 1931.

- (6) LUDIN, M., and WERTHEMANN, A.: Lungenveränderungen nach Experimenteller Röntgenbestrahlung. *Strahlentherapie*, 38, 684-701, 1930.

- (7) GRAHAM, E. A., SINGER, J. J., and BALLON, H. C.: *Surgical Diseases of the Chest*, pp. 575-682. Lea & Febiger, Philadelphia, 1935.

- (8) ARCHIBALD, E.: A Consideration of the Dangers of Lobectomy. *Jour. Thoracic Surg.*, 4, 335-351, April, 1935.

- (9) ROLES, F. C., and TODD, G. S.: Bronchiectasis: Diagnosis and Prognosis in Relation to Treatment. *British Med. Jour.*, 2, 639-643, Oct. 7, 1933.

- (10) WALL, C., and Hoyle, J. C.: Observations on Dry Bronchiectasis. *British Med. Jour.*, 1, 597-602, April 8, 1933.

- (11) BERCK, M., and HARRIS, W.: Roentgen Therapy for Bronchiectasis. *Jour. Am. Med. Assn.*, 108, 517-522, Feb. 13, 1937.

DISCUSSION

MAURICE BERCK, M.D. (New York City): The improvement after therapy usually occurs during the last quarter of treatment and progresses thereafter during a period of from three to four months.

During the course of treatment, the patient's symptoms may be exaggerated, which may lead to discouragement on the part of the patient and also on the part of the therapist. This is a definite part of the radiation effect encountered in the treatment of this disease. Toxicity and cough are more apparent and the patient may run a slight degree of fever. Treatment

may be interrupted if an attack of pneumonitis supervenes.

The first sign of improvement that we notice is loss of fetidity which is accompanied by a decrease in expectoration. There then occurs a concomitant loss of clinical symptoms, a gain in weight, and a loss of clinical toxicity. It is very important to mention this clinical aggravation of symptoms. We have had the experience of learning that in some clinics, where this treatment was used, the therapy was discontinued because the patient was made worse during the course of treatment. I wish to emphasize this phase of the reaction of the patient to this therapy. I should say at least 80 per cent of our patients responded during treatment in like manner. They ran a fever and had an increase in expectoration and cough, at which time they were put to bed. It is not uncommon that a mild case of pneumonitis may be experienced. At this time, of course, the patient should be supported and not subjected to radiation during the height of the pneumonitis.

Clubbing of the Fingers.—I think it is of importance to demonstrate that this is not a permanent phenomenon of bronchiectasis. I have pointed out that clubbing of the fingers, which is well known as a sign of chronic bronchiectasis, subsided in a number of our cases and did not return. The mechanism of this phenomenon is not known. At any rate, we have the clinical picture of a patient rendered clinically well but still with his bronchiectasis, which is now "dry," and disappearance of the clubbing of the fingers.

We realize that in a series of cases over a period of six years now, totalling, in all, 65 cases of totally treated patients, that we

cannot present a statistical summary which will be the final picture. We feel we have a chronic inflammatory disease of the lungs, much akin to tuberculosis, under treatment. We realize that any form of therapy which will salvage some of these patients and rehabilitate them economically and socially is worth while. We do not intend to present a statistical figure which will be permanent and which will prophesy what the result in the future will be. It is sufficient to know that we have a certain number of patients rendered clinically well, and who have sustained their improvement over a period of six years. From experience with a much larger series which would come from all over the country, the statistics might be entirely different. We can say that approximately 50 per cent of our patients have experienced great improvement, *i.e.*, are clinically well. We do not use the word "cured." We perhaps would like to use the word "arrested" such as is used in analysis of results of therapy in pulmonary tuberculosis.

Those patients who have been rendered clinically well, have been arrested of the symptoms of cough, toxicity, expectoration, and the general deteriorated state which goes with chronic bronchiectasis. Whether or not they may in the future infect that "dry" bronchiectatic area, is of course beyond our control, except for treatment of foci of infection such as obvious diseases of the throat and paranasal sinuses. It is sufficient to say that we know from the analogy clinically of "dry bronchiectasis" that, once the patient has "dry bronchiectasis," his prognosis is quite benign.¹

¹ See Reference (10).

DOSAGE AND METHOD OF ROENTGEN THERAPY FOR INFLAMMATORY CONDITIONS¹

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THE treatment of acute or chronic inflammations with roentgen rays dates back about thirty-five years. During the few years which followed Roentgen's discovery, the possible therapeutic value of the rays was first tested in connection with inflammation of the skin, tuberculous processes such as tuberculous adenitis, and cancer of the skin or of deeper structures. The idea of making such tests arose from the observation of cutaneous or other tissue changes which had occurred after certain diagnostic procedures. Then the action of roentgen rays (or radium) on different kinds of tissue was investigated experimentally, and these investigations rapidly increased our knowledge of the cellular effects of exposure to the rays. As the favorable action of the rays on the pathologic conditions mentioned became known, their therapeutic effect on other conditions was gradually put to the test. Thus it has been found that an increasing number of inflammatory conditions often responds favorably to suitable irradiation.

As early as 1902, Williams included among the pathologic conditions which he had found to respond favorably to roentgen irradiation: herpes zoster, psoriasis, eczema, acne vulgaris and rosacea, prurigo, lichen planus, lupus vulgaris or erythematosis, and tuberculous adenitis or peritonitis. Some of these conditions had been treated with more or less success from one to five years earlier by different physicians, including Freund (1897), Albers-Schönberg (1897-1898), Gautier (1897), Rudis-Jincinsky (1898), Pusey (1900), and several others. According to the competent testimony of the famous French dermatolo-

gist, Brocq, who wrote the preface to Belot's important book "Roentgen Therapy for Cutaneous Diseases" (published in 1904), "roentgen therapy already dominates the treatment of skin diseases." Beside the disturbances mentioned by Williams as amenable to roentgen therapy, Belot added sycosis, blepharitis, rhinophyma, and mycosis fungoides. Of course, since we are considering only inflammatory conditions, I shall not mention the early and extensive therapeutic tests made in relation to malignant growths of the skin as well as of other tissues.

It was during the next fifteen years that the treatment of many other forms of inflammation was first investigated. And yet, many present-day radiologists are not even aware of these early investigations and reports, some of which are notable examples of painstaking work and keen observation.

In those early days, much of our present knowledge of the action of roentgen rays on different kinds of cells did not exist. Judged by present standards, the methods of measuring dosage were crude, and the quality of rays then available was limited to wave lengths which could be produced by inferior tubes operating at low electrical potentials. Nevertheless a great deal of the fundamental work was so well done that subsequent investigations could serve only to confirm the results obtained.

Between 1904 and 1910, the main factors which govern the action of roentgen rays on cells were discovered. It was during this same period, as far as the therapeutic effect of roentgen rays on many varieties of inflammation is concerned, that the observation was made that small or moderate doses were sufficient and usually were superior to large doses,

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

such as those employed in the treatment of most malignant processes. This was especially true in acute inflammations, when a single exposure to a small dose (10 to 50 per cent of the erythema dose) often proved sufficient to arrest the pathologic process. In chronic inflammations, on the contrary, larger but moderate doses (50 to 80 per cent) had to be repeated at intervals for some time in order to cure the lesions or to obtain maximum improvement. At that time, and for many years subsequently, the reasons for these and other variations in the action of the rays were vague and uncertain, and numerous plausible or fanciful explanations were advanced. Even to-day our knowledge of the action of roentgen rays on tissues is far from complete. Nevertheless, it is sufficient to give us a good idea of the main changes which follow irradiation and to enable us to understand, at least in part, many of the effects observed clinically.

How can one account for the fact that a single exposure to a small or moderate dose of rays is usually sufficient to influence favorably an acute inflammatory lesion, and that the same favorable effect can be counted on in a large proportion of cases and in different kinds of inflammation? Moreover, the favorable effect of irradiation is perceptible within a few hours after exposure. Any explanation advanced must rest on adequate and well-controlled experimental observations which have been satisfactorily confirmed, and these observations must agree with the clinical data obtained and recorded by numerous competent observers.

To pathologists it has long been known that one of the prominent features of many forms of inflammation, and especially of acute inflammation, is leukocytic infiltration, the degree of which varies according to the kind of bacteria responsible for the inflammation, and perhaps also according to the number of bacteria present. This is but another way of saying that, when the inflammation is due to bacteria, the degree of leukocytic infiltration varies according to the virulence of the infecting

micro-organisms. In a large proportion of cases in which the inflammation is caused by pyogenic bacteria, notably by staphylococci (furuncle, carbuncle, abscess, acute adenitis, etc.), the favorable effect of proper irradiation can be observed within from two to twenty-four hours, and it continues to increase thereafter. If the lesion has been irradiated during the early part of its course, the pain subsides and disappears, although the pain may continue to increase for an hour or two before it begins to diminish. The swelling abates and the lesion gradually undergoes what is known as resolution. When the lesion is irradiated later in its course, the resolving effect of the rays is less striking; pain may diminish just as in the case of lesions which have been treated early, but the analgesic effect takes place somewhat more slowly. A more pronounced effect, however, is that, when the lesion is irradiated after suppuration has started, the suppurative process is hastened and, for this reason, it may become necessary to provide drainage sooner than would be the case with similar lesions which have not been exposed to roentgen rays.

The changes which have been described may be observed in about 75 per cent of the lesions treated. In cases which constitute the remaining 25 per cent, exposure to rays is not followed by any modification which can be recognized as an effect of the rays. This is especially true when the inflammatory process is due to infection by streptococci.

When we try to account for this chain of events, a satisfactory explanation cannot be found until we remember what is known about the great sensitiveness to irradiation of certain varieties of cells, notably the leukocytes (especially lymphocytes, polymorphonuclear neutrophils, and eosinophils). Numerous experiments on animals have long since established the fact that the lymphocytes in lymph nodes, spleen, circulating blood, intestinal follicles, thymus gland, and other structures in which lymphoid cells are to be found, are the most radiosensitive of all the different

kinds of cells in the body. The polymorphonuclear leukocytes and the eosinophils are less sensitive than the lymphocytes, but only slightly less. All three varieties of leukocytes are much more sensitive to irradiation than any other type of cell except the variety of epithelial cell which secretes mucus and which is found chiefly in the salivary glands, stomach and intestine, and bronchi. These mucus-secreting epithelial cells are slightly less sensitive than the lymphocytes and slightly more sensitive than the polymorphonuclear leukocytes and eosinophils, but they seldom play an essential or important part in inflammatory lesions, whereas the three kinds of leukocytes mentioned usually do.

When structures made up largely of lymphocytes are exposed to a small or moderate dose of roentgen rays (or radium), a certain proportion of these cells subsequently undergo degenerative changes and many are destroyed; the degree of this effect, that is, the proportion of lymphocytes thus influenced, depends upon the dose of rays. Moreover, Warthin's experiments showed that this action of the rays begins during irradiation and can be perceived microscopically within half an hour after exposure; in other words, as soon as sections of the irradiated lymphoid structures can be prepared and examined. A small proportion of lymphocytes remains unaffected and serves as a nucleus for subsequent regeneration of these cells, unless excessive or repeated irradiation has destroyed them all. Beginning during irradiation and perceptible soon thereafter, the cycle of cellular changes, as they affect the lymphocytes, increases for two or three days; and then the metabolic activity of the remaining cells (the lymphocytes which were not affected sufficiently to be destroyed) continues at an abnormally low level, especially in relation to mitosis, for from one to three or more weeks. After this, the remaining lymphocytes gradually recover their ability to multiply and, after a time, partial or complete regeneration of these cells takes place. When lymphoid structures are ir-

radiated repeatedly, at relatively short intervals, an increasing proportion of cells is affected, fewer cells are able to survive, and their ability to regenerate and to replace the destroyed cells diminishes more and more, or the cells may disappear completely.

As for the polymorphonuclear and eosinophilic leukocytes in the circulating blood, the degenerative changes induced by irradiation do not become perceptible until from 12 to 24 hours after exposure. A smaller proportion of cells are affected by a given dose, and the resulting cellular changes are similar to those observed in the lymphocytes, although regeneration takes place at about the same time and rate as that of the lymphocytes.

When the affected cells disintegrate, a subsidiary step is that adjacent reticular cells in the lymphoid structures, or in other tissues in the irradiated territory, assume the rôle of phagocytes and ingest the destroyed leukocytes. These reticular macrophages may become quite numerous and, in irradiated inflammatory lesions, they may play an important part in disposing of bacteria and other noxious materials.

In lymphoid structures the lymphocytes destroyed by the rays are replaced by connective tissue, but the proliferation of these cells is slow and does not become apparent until much later. In the meantime, the rapid regeneration of lymphocytes repopulates the lymphoid follicles and tends to mask the increase in connective tissue. It is only after repeated irradiation has brought about marked or permanent disappearance of the lymphocytes that the increase in connective tissue becomes evident. Lymphocytes, polymorphonuclear leukocytes, and eosinophils, destroyed while circulating in the blood, are not replaced by connective tissue; their contents (antibodies, ferments, etc.) are liberated in the blood stream and exert their effects in the same or in some other region.

Now, it is also well known that the degree of leukocytic infiltration in different

kinds of inflammation, or in different cases of the same kind of inflammation, varies considerably. Even in cases of acute infection by staphylococci the degree of leukocytic infiltration varies much in different cases. When the infection is due to streptococci, leukocytic infiltration is often slight and, in the virulent forms of such infection, the number of infiltrating leukocytes in the infected tissues may be small or *nil*. When the infection is diffuse rather than localized, and is caused by virulent bacteria, the leukocytes may not have time to infiltrate the tissues but may elaborate antibodies in the blood stream. Therefore, whatever protective effect the leukocytes may be able to mobilize under these circumstances must be exerted as they circulate through the vessels and capillaries of the infected region.

Anyone who is familiar with the experimental evidence relating to the action of roentgen rays (or radium) on the different varieties of cells, and who tries to correlate and to understand the clinical effects of irradiation, must be struck by one fundamental point of similarity. The rate at which so many acute inflammatory lesions manifest the favorable influence of irradiation corresponds closely to the rate at which normal leukocytes, of the varieties concerned in acute inflammations, are known to be affected by corresponding doses. Could this be a coincidence? Hardly. Those who have attempted to explain on other grounds the action of the rays on acute inflammations have not been successful and have been driven to fanciful and illogical conceptions which do not bear analysis. Beside the many experiments on the action of roentgen rays or radium on normal leukocytes, other experiments on acute inflammations produced experimentally have likewise shown that destruction of leukocytes is a prominent, if not the outstanding, effect of exposure to the rays. The fact that, in a recent series of experiments, Soto, Brunschwig, and Schlutz were unable to observe a similar effect on infiltrating leukocytes may have caused some physicians to

wonder why. In irradiating most of their animals, Soto, Brunschwig, and Schlutz used rays generated at 200 kv., filtered through 1 mm. of copper and 1 mm. of aluminium, and usually gave a quantitative dose of 600 r. The results of their experiments would have been much more conclusive if, under similar conditions, they had tested the effect of smaller quantitative doses (one-tenth to one-fourth of the doses employed) and of a less penetrating quality of radiation. Those who have made comparative clinical tests are aware that, in dealing with acute inflammations and many chronic inflammations also, rays generated at 200 kv. are not so effective as rays generated at a lower voltage (from 100 to 150 kv.). This probably is a matter of the proportion of rays absorbed at the level of the lesion. But another important point is the quantitative dose: Against acute inflammations, doses less than 50 per cent of skin tolerance, and sometimes as low as 5 or 10 per cent of skin tolerance, are distinctly more effective than doses beyond this range. It is possible, therefore, that the factors mentioned may explain why, in their experiments, Soto, Brunschwig, and Schlutz did not observe the cellular changes previously reported by others.

When, in acute inflammation, a proportion of the infiltrating lymphocytes, polymorphonuclear cells, and eosinophils is destroyed by the rays, the contents of these destroyed cells, including the antibodies and other protective substances which have already formed, must inevitably be liberated and scattered among the remaining intact cells. Under these circumstances, it seems probable that the protective substances may become even more effective than when they were held within the cells before irradiation. Certainly there is little ground for the assumption that irradiation increases the production of antibodies. On the contrary, the experiments of Hektoen (5-7) and others indicate that irradiation tends to diminish the formation of antibodies.

As far as chronic inflammations are con-

cerned, a satisfactory explanation of the influence of roentgen rays or radium must be based on the pathologic character of the lesions and on the known action of the rays (as disclosed by experiments) on the kinds of cells present in the lesions. When chronic inflammations are considered, leukocytic infiltration plays a less important part, but another, and sometimes a more prominent, feature is proliferation of connective tissue. Besides these two features, the relative proportion of which varies in different forms of chronic inflammation as well as in different cases or stages of the same form, some chronic inflammations are also characterized by varying degrees of central necrosis, caseous degeneration, calcification, or hyaline or amyloid change.

Cells which have already undergone necrosis cannot be influenced by the rays because these cells are already dead. Cheese and chalk, since they are end-products of cellular degeneration, also are impervious to the action of the rays; likewise, hyaline and amyloid material are products of cellular degeneration and should be classed in the same category. As susceptible of being influenced by irradiation, therefore, only infiltrating leukocytes and proliferating connective tissue remain. We are familiar with the great radiosensitiveness of the varieties of leukocytes which usually infiltrate inflamed tissues. In this respect, connective tissue cells, which are relatively resistant to irradiation, provide a sharp contrast. These cells are not affected directly by the doses of rays which ordinarily have the greatest effect on chronic inflammations, but the proportion of connective tissue present may be affected indirectly as a result of the destruction of leukocytes. This indirect increase in connective tissue, however, is comparatively slow. In different kinds or at different stages of chronic inflammation, caused by the same kind of infection or due to some other etiologic factor, the relative proportion of leukocytic infiltration and connective tissue proliferation varies considerably. When

leukocytic infiltration preponderates over connective tissue proliferation, this should cause the rays to have a greater and more rapid action on the inflammatory process, and *vice versa*. This is precisely what is observed in practice, as far as clinical observation allows. When the lesions have not been present a long time, they are distinctly more amenable and respond to treatment more rapidly than when they are of long standing and the leukocytic infiltration has been replaced by connective tissue to a greater extent. Moreover, the considerable, though varying, proportion of these two factors in all chronic inflammations probably explains why such inflammations respond to treatment so much more slowly than acute inflammations, why larger quantitative doses of rays are necessary, and why, if satisfactory results are to be obtained, the treatment must be repeated at intervals for some time.

METHOD

If the considerations which have been set forth are as valid as they appear to be, what influence should they have on the method of irradiation?

The first and most important point is that, when dealing with inflammatory conditions, whether acute or chronic, the concept of maximum, tolerance, or tumor doses must be abandoned. Not only are they less effective, but they are actually dangerous. In treating most malignant tumors, it is essential that the neoplasm should receive the maximum dose which can be delivered to it without undue injury to overlying or surrounding normal tissues. To follow this principle in treating inflammatory conditions would be a waste of electrical energy, a gross waste of time on the part of the personnel as well as of the patient, and an unwarranted increase in cost. But, still more important, there would be danger of inducing in the affected tissues an inflammatory reaction independent of that which is already present and this might readily lead to spread rather than resolution of the infection.

principles of sound treatment would thus be violated. This probably explains why some radiologists have failed to obtain the favorable results which should follow proper treatment. But the possibility of spreading the infection by excessive doses is not the only danger. Experiments on animals, carried out by Lacassagne and Vinzent, have shown that, when acute inflammatory lesions induced by injecting *Streptobacillus caviae* into rabbits were exposed to doses of roentgen rays such as are used in the treatment of malignant processes, a considerable proportion of the animals subsequently developed sarcomas in the same region.

For acute inflammations, especially those due to infection by staphylococci or to trauma, experience has shown that a single, small dose (from 10 to 50 per cent of the erythema dose) is usually sufficient and yields the best results. Occasionally, when a single exposure has not had the desired effect, a second exposure several days after the first may be worth trying. For example, the first dose may result only in partial resolution, and a second dose may be necessary to complete the effect. The more acute the inflammation, the smaller the dose usually required.

An important point is that the field of irradiation should not be confined too closely to the visible limits of the inflamed area, but should include a wide zone of apparently normal tissues. This deserves more attention than it frequently receives and is especially true when the inflammation has been caused by virulent bacteria, such as streptococci or *Bacillus welchii*. Here, because the limits of infection are often uncertain, because leukocytic infiltration often is slight or practically non-existent, and because it is essential to have the rays act on leukocytes in the blood circulating through the inflamed region and all around it, the advantage of treating widely cannot be stressed too much. When a patch of erysipelas covers one cheek, for instance, the entire side of the head and a good part of

the neck should be included in the field of irradiation.

In treating inflammations caused by highly virulent bacteria such as *Bacillus welchii*, Kelly (8-11) has found advantage in using small doses and repeating them daily or twice daily for several days. The reason why such a procedure should be more effective is not clear. It is possible that when the infecting bacteria have a high degree of virulence, a single irradiation may not influence a number of circulating leukocytes sufficient to overcome the infection. But when irradiation is repeated daily or twice a day for three or four days, the number of circulating leukocytes acted on by the rays must necessarily be much greater, and this may possibly account for the greater efficacy of Kelly's method in the treatment of this kind of infection. Inasmuch as streptococcal infections often assume a virulent form, and leukocytic infiltration is often slight or wholly lacking, it is possible that the same method of small doses repeated daily or twice daily for three or four days might have a similar advantage.

As far as the quality of the rays is concerned, there seems to be little doubt that rays generated at moderate voltage such as from 100 to 150 kv. (the "New Dealers" in radiology would now call this "low" voltage) and filtered through 4 or 6 mm. of aluminium or through copper of equivalent filtration value, are more effective than rays generated at 200 kv. or more. In all probability, the superiority of rays of medium wave length is due largely to the greater absorption of these rays by the inflamed tissues, and, perhaps, to a difference in the scattering factor also influencing absorption. Whether or not these related factors constitute an adequate explanation remains to be determined.

When roentgen rays (or radium) are employed in the treatment of chronic inflammations, as I have already mentioned, larger, though still moderate doses (50 to 80 per cent of erythema), must be repeated at intervals for some time in order to cure the lesions or to obtain maximum improve-

DISCUSSION

PAUL D. MOORE, M.D. (Muncie, Indiana): This symposium has been informative and stimulating, but I believe I have not heard any of the speakers mention the x-ray treatment of streptococcic septicemia. I refer to cases that are medicine-fast, resisting medical treatment.

Your minds quicken with a sense of familiarity upon recalling your own cures of such streptococcal infections as erysipelas, acute otitis media, acute mastoiditis, and even streptococcal pneumonia following roentgen therapy. I have treated all of these conditions successfully and the hospital staff refers such cases to me with enthusiasm. It would be useful to check results against the specific strain of the organism. My cases were mostly due to *Streptococcus hemolyticus*. It is possible that the rarer types, such as *S. viridans* and *S. putridus*, may not respond, but we still have this to learn.

Since the few patients I have treated do not warrant a statistical comparison, case reports must suffice to give you a clinical impression. A female, 15 years of age, entered the hospital with temperature 103.5° and bilateral acute otitis media of two weeks' duration. Mastoid radiographs revealed non-development of cellular structure. A myringotomy was performed but septicemia and bilateral pneumonitis developed. Radiographs revealed diffuse parenchymal involvement of both lungs, and blood cultures were positive for hemolytic streptococci.

In spite of large doses of sulphanilamide, Congo Red and even Cadham's hyperimmune rabbit serum from Winnipeg (which reputedly yields 90 per cent cures), the patient steadily became worse. Consultants from the University Medical Center indicated a fatal outcome and when I was called at the end of four weeks to see the patient the relatives also were called for presence at the death.

The mobile unit at the bedside was used to deliver through the cellophane of the oxygen tent 75 r in air, over the chest, in

one treatment. In 15 hours improvement justified removing her from the oxygen tent and treating each ear with 100 r of x-ray. An uneventful recovery followed and she has been normally well for this past year. The pneumonia, septicemia, and bilateral otitis all healed completely.

Without making any claims on the basis of a few cases, I report on an adult male whom I treated, in 1932. He had a bilateral acute mastoiditis which had been treated surgically. The complication of lateral sinus thrombosis, although treated by surgical intervention, failed to cure or prevent a hemolytic streptococcic septicemia from developing. Positive blood cultures were recorded daily. Transfusions of blood, surgical drainage of very deep multiple abscesses, and exceedingly good private nursing failed to revive the patient. Consultation from the University Medical Center was obtained and the patient was sent for x-ray therapy in a condition of cachexia, profound anemia, and stupor.

One hundred roentgens in air over the spleen and over the liver was given, bearing in mind the effect on the reticulo-endothelial system. The method was experimental and the dose arbitrary. The next day the patient spoke. He at least was not worse and we were encouraged to treat him daily in the manner just mentioned. At the end of seven days the blood culture was negative and in another week he had a dinner party with friends. The recovery was uneventful except for a mild infectious arthritis of one shoulder, which responded to physical therapy. The patient is living to-day and perfectly well.

I hope these cases will stimulate those of you who have access to numerous patients of this type to make a statistical study, including a study of the type of streptococcus. Certainly in a large group of cases there will be a percentage of failures. For instance, one patient with streptococcic septicemia failed to respond to Cadham's hyperimmune rabbit serum and sulphanilamide therapy. She had already developed a brain abscess. Under

no circumstances did her fever drop in spite of good medication and care. The only time the temperature reached normal was the day following an x-ray treatment. She was transported to another hospital for surgical intervention of the brain abscess, and died.

As I said before, I refer to medication-

resistant cases of streptococcic septicemia, especially hemolytic. If the primary lesions were treated early with x-ray, then the secondary septicemia and its complications could be prevented. Simultaneous chemotherapy is not contra-indicated and is an extra safeguard, but is often unnecessary.

EFFICIENCY CURVES IN QUANTITATIVE RADIOBIOLOGY

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If the characteristics of the tissue and the physical conditions of the irradiation are known, it is possible to plot two related sets of curves, the one showing the correlation between the quantitative biological effect M and the variable irradiation time t for constant radiation doses q_A, q_B, q_C, \dots , and the other showing the correlation between M and

consistent with all the experimental work that has been done in this field.

Reference to Figure 1 shows that some of the curves exhibit maximum values which drift progressively in the direction of increasing time as the radiation dose is increased (1). Other curves (q_A , etc.) in the same family show that M falls continuously as t increases, and one par-

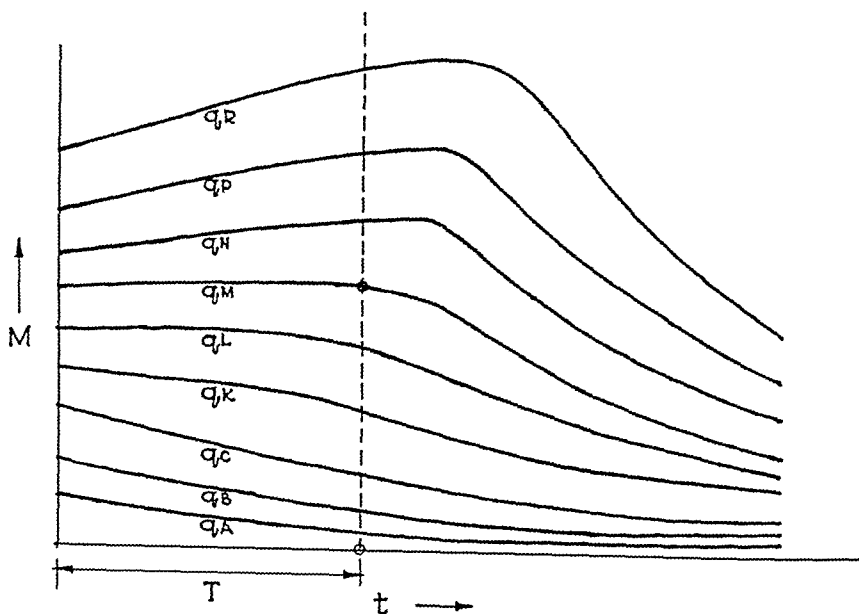


Fig. 1.

the variable radiation intensity α for the same radiation doses.

When an attempt is made to draw these curves for the most general case of any irradiated tissue several complexities are encountered, but if we exclude the most rapidly proliferating tissues (I), they can be constructed without great difficulty.

By employing the results obtained in an earlier publication (1), it can be shown that the curves cannot cut, and that they can be generally represented as in Figures 1 and 2, in which T represents the duration of the radio-sensitive period (I).

These results, analytically obtained, are particularly instructive and appear to be

particular curve (q_M) exhibits the complete independence of M and t over a particular range of t .

From Figure 2 we see that the critical intensity, *i.e.*, that intensity with which is associated maximum biological effect for a given dose, is in general a function of the radiation dose, that in certain circumstances it may vary slowly with the dose, and that it may even be independent of the dose (1). The maxima in this case drift progressively in the direction of decreasing intensity as the radiation dose is increased, and it can be shown that the maximum possible range of variation in the critical intensity is q_L to q_M , these

latter quantities being determined by the characteristics of the tissue.

The practical importance of realizing

the significance of the several other symbols² being clearly indicated in Figures 3 and 4.

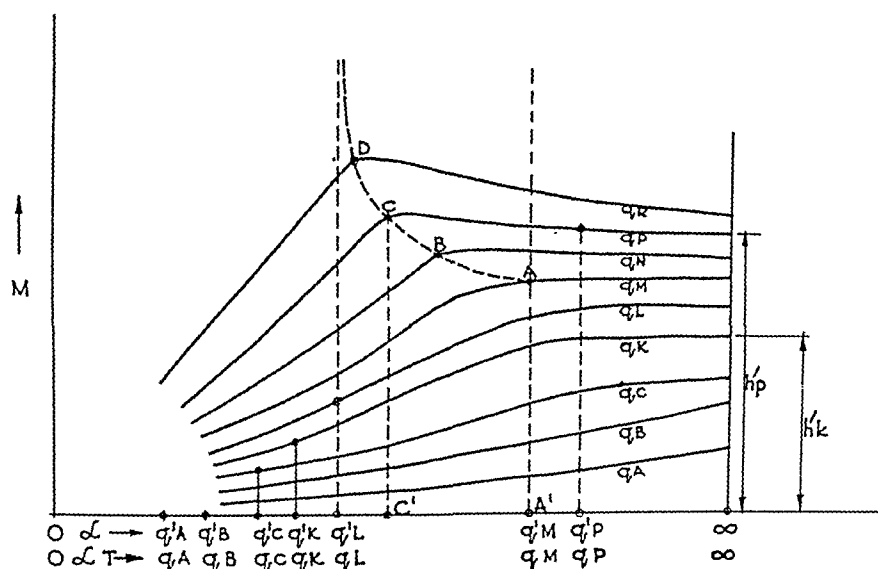


Fig. 2.

the critical intensity is seen to vary with the dose, and a quantitative estimate of the effect of a given departure from the critical intensity can be easily obtained.

If, as in a previous publication (2), the mortality curve¹ is represented by $Q = f(q)$ (Figs. 3 and 4), then the resultant mortality sustained by a tissue irradiated with a dose q_1 , at a rate α , is given by

$$M_1 = \frac{\partial N}{\partial t} \cdot T \left\{ \frac{2A_1}{q_r} - \left(\frac{q_1}{q_r} - 1 \right) h_1 \right\} \quad (1)$$

when

$$q_r = \alpha T > q_1$$

and by

$$M_1 = \frac{\partial N}{\partial t} \cdot T \left\{ \frac{2A_r}{q_r} - \left(\frac{q_1}{q_r} - 1 \right) h_r \right\} \quad (2)$$

when

$$q_r = \alpha T < q_1$$

If α is the critical intensity for a dose q_1 we have

$$-2A_r + 2q_r h_r - q_1 h_r + q_r (q_1 - q_r) \frac{\partial h_r}{\partial q_r} = 0 \quad (3)$$

and as q_1 increases indefinitely α approaches the value determined by

$$\left(\frac{\partial h_r}{\partial q_r} \right)_{q=q_L} = \frac{h_L}{q_L} \quad (4)$$

a result which can be interpreted in relation to Figure 5, in which OT is the tangent from the origin, and OM the line with which the curve forms segments of equal area.

It follows from this that the curve connecting the several maxima in Figure 2 is asymptotic to q'_L where

$$q'_L \cdot T = q_L \quad (5)$$

and it can also be shown that

¹ The mortality curve exhibits the relationship between the dose q and the fractional mortality, or the fractional biological effect Q .

² $\frac{\partial N}{\partial T}$ in the case considered here is a constant.

$$q_M^I \cdot T = q_M \quad (6) \quad \text{and}$$

It is convenient to call αT the partial dose for any intensity α , and if we plot the mortality against partial dose (Fig. 2), several significant relationships are immediately established, and further simplifications are introduced into the subsequent analysis.

If, as previously, we define the biological efficiency E as the ratio between the mortality and the radiation dose, it becomes clear that Equations 4 and 5 define the intensity with which is associated maximum biological efficiency on the primary mortality curve.

From Equations 1 and 2 we get

$$E_1 = \frac{M_1}{q_1} = \frac{\partial N}{\partial t} \cdot \frac{T}{q_1 q_T} \{2A_1 + (q_T - q_1)h_1\} \quad (7)$$

when

$$q_T > q_1$$

$$E_1 = \frac{M_1}{q_1} = \frac{\partial N}{\partial t} \cdot \frac{T}{q_1 q_T} \{2A_T + (q_1 - q_T)h_T\} \quad (8)$$

when

$$q_T < q_1$$

If we now write

$$E_1 = f(q_1, q_T)$$

it will be seen that this function is symmetrical in q_1 and q_T , i.e., $f(q_1, q_T) = f(q_T, q_1)$ from which it follows that the curves E_1 , q_1 obtained by ascribing to q_T a series of constant values, q_A , q_B , q_C , etc., are identical with the curves E_1 , q_T , obtained by ascribing the same constant values to q_1 . In other words, total dose and partial dose are interchangeable in the above sense

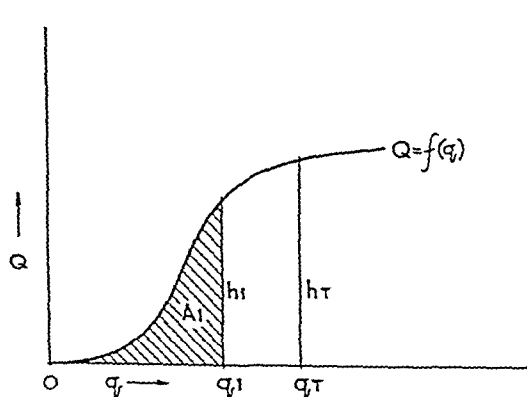


Fig. 3.

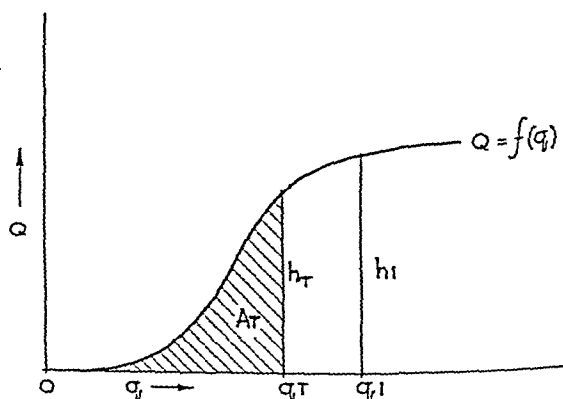


Fig. 4.

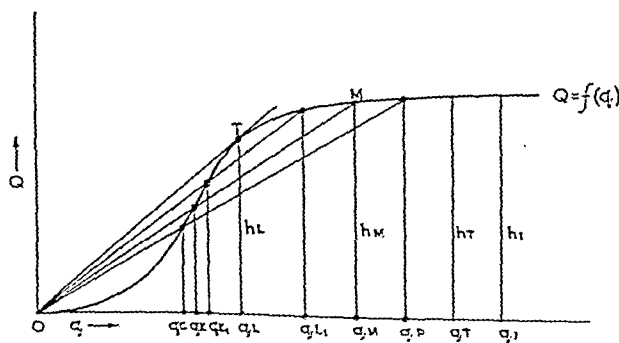


Fig. 5.

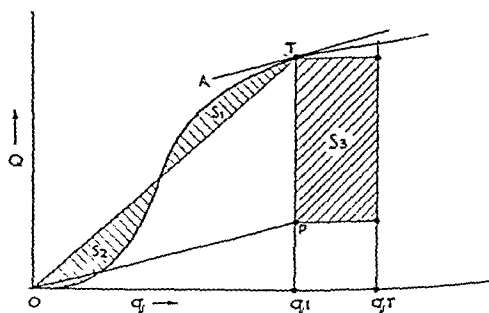


Fig. 6.

We can now go on to show that

$$\frac{\partial E_1}{\partial q_1} = -\frac{\partial N}{\partial t} \cdot T \cdot \frac{2}{q_T q_1^2} \left\{ S_1 - S_2 + \frac{S_3}{2} \right\} \quad (10)$$

when

$$q_T > q_1$$

and that

$$\frac{\partial E_1}{\partial q_1} = -\frac{\partial N}{\partial t} \cdot T \cdot \frac{2}{q_T q_1^2} \{ S_1 - S_2 \} \quad (11)$$

when

$$q_T < q_1$$

S_1 , S_2 and S_3 being the areas shown in Figures 6 and 7 and OP being the parallel to AT the tangent at T in Figure 6.

When these results are considered to-

gether in relation to Figures 2 and 5, it will be found that

(1) If $q_T = q_P > q_M$ the efficiency increases with q_1 to a maximum value $\frac{CC^1}{q_P}$ which is realized for some particular value of the partial dose, between q_L and q_M , then decreases to a limiting value $\frac{h_P}{q_P} \cdot \frac{\partial N}{\partial t} \cdot T$.

As q_T increases, the partial dose determining the position of the maximum approaches q_L .

(2) If $q_T = q_M$ the efficiency increases with q_1 to a maximum value $\frac{AA^1}{q_M}$ which is realized when $q_1 = q_M$ and then remains independent of q_1 .

(3) If $q_T = q_K < q_M$ the efficiency in-

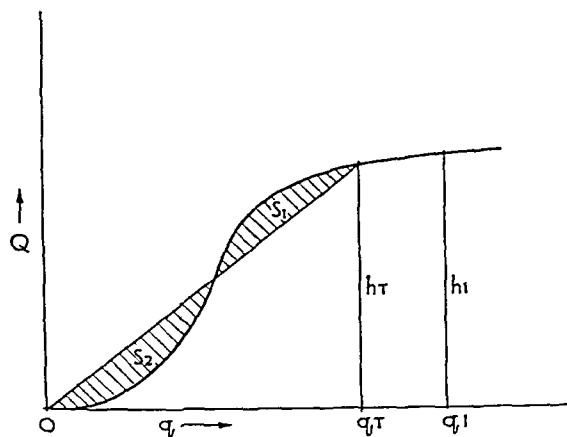


Fig. 7.

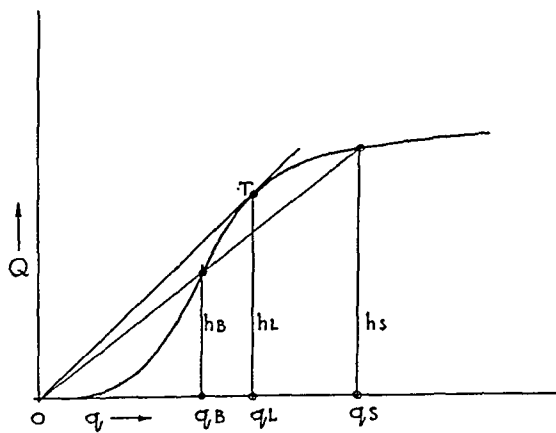


Fig. 8.

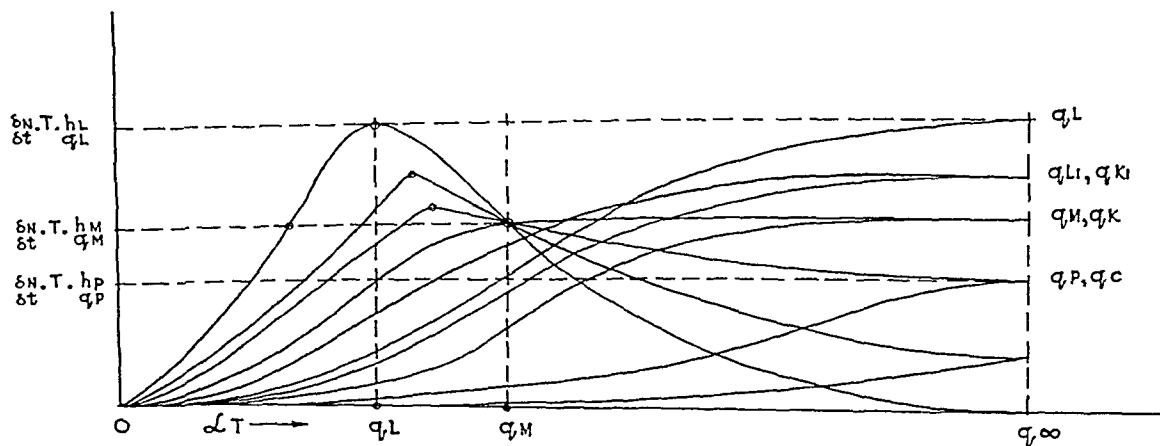


Fig. 9.

creases continuously with q_1 to a limiting value $\frac{h_K}{q_K} \cdot \frac{\partial N}{\partial t} \cdot T$.

If h_K and h_P are the limiting ordinates for infinite intensity on the mortality intensity curves q_K and q_P (Fig. 2), we see that

$$h_K = h_K \frac{\partial N}{\partial t} \cdot T$$

and

$$h_P = h_P \frac{\partial N}{\partial t} \cdot T$$

and in virtue of the obvious property (Fig. 8)

$$\frac{h_B}{q_B} = \frac{h_S}{q_S}$$

which must exist for pairs of points on either side of T , it is clear that pairs of efficiency curves pass to the same limits, which are all less than $\frac{h_L}{q_L} \cdot \frac{\partial N}{\partial t} \cdot T$.

We will now investigate the variation in the maximum efficiencies associated with the critical intensities, that is to say, along the curve A B C D... (Fig. 2).

The condition that a critical intensity exists is that the total dose q_1 must be greater than q_M , and if this condition is satisfied the partial dose q_T , which determines the critical intensity, is given by equation (2), which, when combined with equation (8) leads to

$$E_{1(\max.)} = \frac{\partial N}{\partial t} \cdot T \left\{ \frac{h_T}{q_1} + \left(1 - \frac{q_T}{q_1} \right) \frac{\partial h_T}{\partial q_T} \right\} \quad (12)$$

It can be shown that

$$\frac{\partial}{\partial q_1} \{ E_{1(\max.)} \} = \left\{ \left(1 - \frac{q_T}{q_1} \right) \frac{\partial^2 h_T}{\partial q_T^2} \cdot \frac{\partial q_T}{\partial q_1} + \frac{1}{q_1^2} \left(q_T \frac{\partial h_T}{\partial q_T} - h_T \right) \right\} \quad (13)$$

and substituting the value

$$\frac{\partial q_T}{\partial q_1} = \frac{h_T - q_T \frac{\partial h_T}{\partial q_T}}{q_T(q_1 - q_T) \frac{\partial^2 h_T}{\partial q_T^2}} \quad (14)$$

we find

$$\frac{\partial}{\partial q_1} \{ E_{1(\max.)} \} = \left(\frac{q_1 - q_T}{q_1} \right)^2 \frac{\partial^2 h_T}{\partial q_T^2} \cdot \frac{\partial q_T}{\partial q_1} \quad (15)$$

which is clearly positive and $E_1(\max.)$, therefore, increases with q_1 , and approaches the limiting value

$$\frac{h_L}{q_L} \cdot \frac{\partial N}{\partial t} \cdot T.$$

We are now in a position to construct the efficiency curves which are shown in Figure 9. In this system of curves partial dose and total dose are interchangeable in the sense previously established, the significance of the several symbols in relation to the primary mortality curve being clearly shown in Figure 5.

It will be observed that the intensity or partial dose with which maximum efficiency is associated tends to become independent of the dose as this increases (1). The partial dose approaches q_L , namely, that partial dose with which is associated maximum efficiency on the primary mortality curve, and the efficiency approaches the maximum possible value $\frac{h_L}{q_L} \cdot \frac{\partial N}{\partial t} \cdot T$. The efficiency for any other partial dose q_S , likewise, approaches $\frac{h_S}{q_S} \cdot \frac{\partial N}{\partial t} \cdot T$.

These latter results are a direct consequence of the fact that, for any fixed partial dose, the mortality sustained by cells in the radiosensitive condition at the commencement of the irradiation, becomes small compared with that sustained by cells which are subsequently irradiated.

BIBLIOGRAPHY

- (1) British Jour. Radiol., 10, 38-45, January, 1937.
- (2) British Jour. Radiol., 6, 387, 1933.

ROENTGENOGRAPHIC IMAGES IN PRIMARY CARCINOMA OF THE LUNG

By LEW A. HOCHBERG, M.D., C.M., *Brooklyn, New York*

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It would not be pleonastic to reiterate that the co-operative efforts of the internist, roentgenologist, bronchoscopist, pathologist, and thoracic surgeon have contributed immeasurably to our rapid advancement in the study of carcinoma of the lung. Without such teamwork there would have been relatively little progress in attaining an earlier recognition of this disease. These endeavors have undoubtedly popularized this disease and may, in a large measure, account for the current beliefs that there is an increase in the incidence of primary carcinoma of the lung.

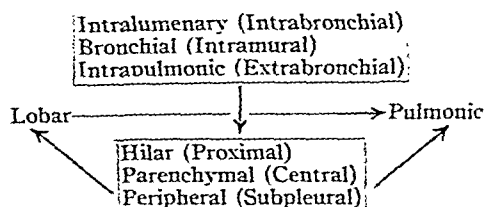
As early as 1910, Otten showed that there were two forms of malignant neoplastic disease of the lung. Several years later, Assmann was able to subdivide pulmonary carcinomas into six roentgen forms. About this same time Tovell showed that there was a relationship between the type of lesion and the roentgen-ray picture. In more recent times, Kirklin and his co-workers have again considered carcinoma of the lung to be of two primary forms, namely, bronchial and parenchymal. Hyde and Holmes prefer to classify bronchogenic carcinomas as obstructive and non-obstructive; Rabin and Neuhof suggest that they be classified as circumscribed and non-circumscribed. Wasch and Epstein believe that the clinico-roentgenographic subdivision should be on the basis of the degree of progress of the lesion and they, therefore, subdivide bronchogenic carcinomas into early, moderately advanced, and far advanced.

The writer proposes a roentgenographic classification of primary carcinoma of the lung which is based upon the pathologic changes within the lung. This classification recognizes three modes of growth: (1) In which the tumor is *intraluminary* (intra-bronchial) and produces roentgen

changes characterized by bronchial obstruction; (2) the *bronchial* (intramural) which is characterized by a carcinomatous extension along the lymphatics of the bronchial tree, and (3) an *intrapulmonary* (extrabronchial) form in which the neoplasm grows outside the lumen of the bronchus and extends around it, forming a peribronchial mass within the lung tissue. Regardless of whether or not the growth extends into the lumen of the bronchus, along the wall of the bronchus, or outside the bronchus, the site of origin is either at the *hilum*, in the *parenchyma*, or at the *periphery* of the lung. The roentgenographic changes associated with a carcinoma of the lung will, therefore, depend upon the location of the primary growth, its size, mode of growth, effect upon the neighboring structures, and the secondary changes within the lung incidental to the expansion of the neoplasm.

There is no roentgen picture pathognomonic of carcinoma of the lung. It is only after considering the history and clinical course that we may venture an opinion as to whether or not a roentgen film is suggestive of pulmonary neoplastic disease. Thus, a massive pleural effusion may hide an underlying process which may or may not be carcinomatous; an aspirated foreign body or a polyp within the bronchus may produce a massive collapse of the lung simulating an obstructing carcinoma of the bronchus; a solitary metastatic hypernephroma may have many of the characteristics of a parenchymal carcinoma; enlarged hilar glands due to Hodgkin's disease or an aortic aneurysm may be mistaken for a hilar bronchogenic carcinoma. However, with the aid of the history and clinical course, the interpretation of roentgenographic studies should be considerably simpler. The proposed

classification¹ may be represented schematically as follows:



Hilar.—In this type, the primary growth arises from the bronchus at, or near, the root of the lung. The bronchus at this site has a wide lumen, therefore, an intrabronchial growth in this region must attain considerable size before it can obstruct the bronchus and produce a massive atelectasis. At its inception, a hilar neoplastic process cannot be detected by roentgenography. It is not surprising, therefore, that in the earliest stages the growth will escape recognition. When, however, it has increased in size, or has extended to the hilar lymph nodes, it may be recognized by the regional opacity. This area presents a unilateral, hilar, and more or less homogeneous infiltration (Fig. 1). At this early stage, the primary growth need not be visible on the roentgenogram. The size of the shadow varies with the duration of the disease, the rate of growth of the neoplasm, and the rate at which the lymphatics and pulmonary tissue become involved. The shape of the opacity is semicircular or triangular, with its convexity or base directed toward the lung tissue on the side of the neoplasm.

Stivelman pointed out that an endobronchial tumor may extend through the wall of the bronchus and infiltrate the tissues in the region of the hilus, *via* the lymphatics, and form nodular, glandular growths along the bronchial wall. As the mother tumor increases in size (still not obstructing the bronchus), the regional lymph nodes continue to increase in size

and cast a unilateral shadow, which, together with the neoplasm, remains fairly well demarcated from the surrounding lung tissue. The edges of the solid mass and surrounding lung parenchyma frequently will show infiltrative, radiating projections and congestive changes (Fig. 2). At this stage, the growth is generally of an uneven radiolucency, and may appear lobulated with a nodular or irregular lateral border. The opacity is due to the tumor, glands, and reactionary changes, no one of which can be distinguished from the other. The proximal part of the infiltration is usually confined to the level between the fifth and ninth dorsal vertebræ. Oblique and lateral roentgenographic studies may show a retrocardiac or mediastinal opacity (Fig. 3). If the tumor and glands have attained an appreciable size, the heart may be displaced anteriorly or rotated away from the affected side.

As the intrabronchial tumor increases further in size, and an intramural lymphatic spread of the disease takes place, the mucosa becomes congested, edematous, and pressed upon from without. As a result of the inflammatory and neoplastic changes within the lung, superimposed upon the condition within the bronchus, the latter soon becomes obstructed, and atelectasis ensues. The extent of the atelectasis depends on the size of the bronchus occluded, and may, therefore, be massive, when the main bronchus is affected (Fig. 4), or lobar, when a stem bronchus is occluded (Figs. 5 and 6). In those instances in which atelectasis has taken place, there is a more or less uniform opacity of the lung or lobe with diminished opacity toward the peripheral part of the lung-field; the intercostal spaces are narrowed, the diaphragm is elevated, and the mediastinum may be somewhat retracted toward the affected side. Frequently, the mediastinum is fixed, due to the surrounding inflammatory changes secondary to the neoplastic process, in which instances the mediastinum will not be displaced.

¹ This classification recognizes the site of origin in all cases of carcinoma of the lung, as the bronchus or some subdivision thereof.

The roentgenogram in the early extra-bronchial or intramural hilar type of neo-

plasm is essentially the same as that of the intrabronchial type. In the extrabron-

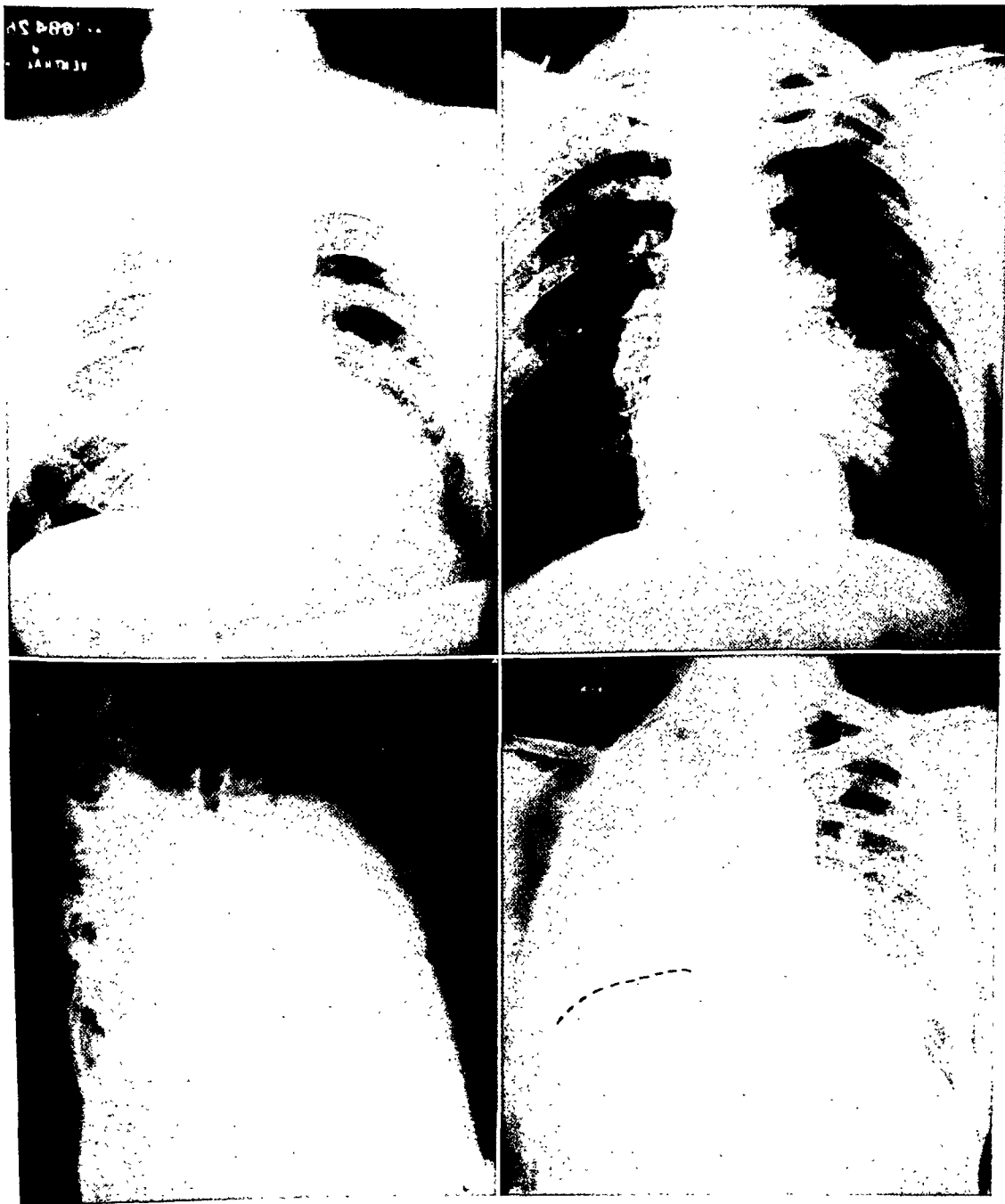


Fig. 1 (*upper left*). Unilateral (right) hilar glandular enlargement with some infiltration of the proximal part of the lung parenchyma.

Fig. 2 (*upper right*). Bilateral hilar glandular enlargement, more pronounced on the left. Note the irregular mottled appearance of the left hilar opacity and its irregular distal edge.

Fig. 3 (*lower left*). Lateral view of the chest in a patient in whom the anteroposterior view showed only a suspicious infiltration jutting out from behind the heart. There is a dense retrocardiac opacity.

Fig. 4 (*lower right*). Atelectasis of the right lung. The right hemithorax appears smaller than the left; the right diaphragm is elevated; the heart is not retracted.

chial and intramural types of carcinomas, later studies may show considerably more parenchymal involvement and more secondary pneumonic changes. In those cases in which the primary growth is in the main bronchus and is of the intramural variety,



Fig. 5 (upper left). Atelectasis of the right upper lobe due to an obstructing carcinoma of the bronchus supplying that lobe. The remainder of the lung tissue appears emphysematous. The heart is not displaced.
 Fig. 6 (upper right). Same case as shown in Figure 5. Lateral view of the chest in a case of carcinoma of the right upper lobe. Note the sharp horizontal line of demarcation and the opacity above it.
 Fig. 7 (lower left). A triangular veil-like opacity extending out into the left lung-field.
 Fig. 8 (lower right). Obstructing carcinoma of the left lower lobe bronchus. The line of demarcation between the diseased and healthy lung tissue is indistinct. In addition, there is a pathologic fracture of the anterolateral part of eighth rib on the right side.

the retrograde lymphatic infiltration of the lung causes a fan-shaped, veil-like carcinomatous and inflammatory opacity. A roentgenogram of this lesion shows considerable striation, or linear infiltration of the lung, which extends outward from the hilum (Fig. 7). Within these striations, there are many various-sized, distinct nodular areas of greater density than the surrounding opacity. These areas correspond to sites of bronchial lymph node enlargement. The radiolucency of the lung appears unevenly diminished, the greatest density being at the hilus. If, however, the primary growth originated in a secondary bronchus, the spread is in a lobar fashion and the roentgenogram shows similar linear infiltration, opacity, and nodular areas sharply confined to one lobe of the lung and limited by the interlobar fissures (Figs. 5 and 6). The area of infiltration is triangular, the apex of which is directed toward the hilum. In those cases in which the primary growth is least malignant, the spread is comparatively slow and the unaffected lung tissue may undergo emphysematous changes; the diaphragm may become depressed and the trachea pushed toward the contralateral side. The contrast of emphysematous lung and infiltrated lung makes the interlobar fissure appear as a sharp line of demarcation, when the carcinoma is in the upper lobe. When, however, it is in the lower lobe the interlobar line of demarcation is less distinct and often irregular (Fig. 8). In the final lobar stage, the lobe becomes dense, irregularly opaque, and contains many areas of increased density (nodular areas), the outline of which is indistinct. The lobar type may be present in any part of the lung, but is more often seen in the upper lobes where it is frequently confused with tuberculosis and pneumococci pneumonia.

Parenchymal.—The parenchymal lesion is generally an extrabronchial neoplastic process, arising from a secondary or tertiary branch bronchus, which grows more or less centrifugally about the bronchus as an axis (Fig. 9). On the roentgenogram

it appears, therefore, as a circumscribed round or ovoid opacity distinct from the hilum and periphery of the lung. The lung tissue about the primary growth often undergoes emphysematous changes. As the growth increases in size, it generally loses its delineation and appears as an agglomeration of soft and hard shadows (Fig. 10). Extending outward from the edges of the tumor and into the surrounding lung tissue there are infiltrative neoplastic and inflammatory projections. At this stage, the line of demarcation between tumor and lung tissue becomes indistinct. The infiltrative strands leading toward the hilum are denser than those leading toward the periphery. The hilar glands become enlarged and dense. As the process continues, the infiltration becomes more pronounced, the original growth becomes further obscured, and the entire lobe becomes unevenly opaque. At this stage, it cannot be distinguished from the lobar type of neoplasm which had its inception at the hilum. Still later, the entire lung may become involved in the neoplastic process, at which time it cannot be distinguished from the advanced hilar form.

Peripheral.—This form of primary carcinoma of the lung appears to have been given little attention, as evidenced by the paucity of references to it in the literature. Most writers believe it to be pleural involvement, secondary to the hilar or parenchymal forms. The peripheral form of primary carcinoma takes origin in the smaller bronchioles, perhaps the terminal bronchioles near the surface of the lung, and rapidly infiltrates and extends along the subpleural lymphatics, chest wall, and diaphragm. In the early stages, roentgen examination shows a localized opacity at the pleura with proximal lung infiltration. It is very frequently accompanied by an encapsulated hydrothorax (Fig. 11). As the process advances, it involves the entire pleura and the peripheral part of the lung-field. On the roentgenogram there is an uneven opacity of the hemithorax which in many ways resembles a pleural



Fig. 9 (*upper left*). A parenchymal (central) carcinoma of the left upper lobe bronchus. The area medial to the growth is infiltrated, whereas the lateral part is clear. The lower part of the ovoid shadow presents an annular shadow (excavation).

Fig. 10 (*upper right*). A large parenchymal carcinoma of the right lung with infiltration about the mother growth.

Fig. 11 (*lower left*). Carcinoma of the left upper lobe at the periphery of the lung-field. There is a pathologic fracture of the posterolateral part of the fourth rib on the left side. The tumor and pleura are well demarcated from the underlying lung tissue.

Fig. 12 (*lower right*). Peripheral (subpleural) carcinoma of the left upper lobe. There is an ovoid opacity extending from the third rib down to below the level of the seventh rib. The surrounding pleura is infiltrated. There is a pathologic fracture of the fourth rib which overlies the tumor.

effusion. Not infrequently it will erode the underlying ribs (Fig. 12). The position of the mediastinum remains unaltered. Attempts at aspiration may yield a small amount of fluid. Roentgen studies after the aspiration show no change in the opacity of the hemithorax as compared with the roentgen studies made before the aspiration. This is because the underlying opacity is due to a carcinomatous lymphangitic infiltration. Careful examination of the roentgenogram may show miliary dense deposits on the surface of the pleura and in the peripheral lung-fields. The hilar glands remain uninvolved until late in the course of the disease. As the pleural nodules grow they tend to coalesce and produce a uniform opacity.

Regarding apical peripheral carcinomas, Jacox quotes Pancoast as follows: "The name of 'superior pulmonary sulcus tumor' has been given it because this term implies its approximate location and a lack of origin from lung, pleura, ribs, or mediastinum. It is possible that this new designation may be changed again, with a better knowledge of the histopathology of the growth." He further adds, "Opportunity to examine autopsy material from a case of this sort has convinced me that, at least in this instance, the tumor arose from the mucosa of the terminal bronchioles in the apex of the lung, and that the name 'primary carcinoma of the pulmonary apex' might be appropriate." Many investigators are in accord with Jacox and believe that the so-called "superior pulmonary sulcus tumors" are carcinomas of the lung, of peripheral apical origin (Fig. 13).

The foregoing, in summary form, describes the three roentgen forms of primary carcinoma of the lung, as seen in the uncomplicated cases, and the pathogenesis of each. The roentgenographic intrathoracic complications and secondary changes which may ensue are: (A) Pleural effusion; (B) bronchiectasis; (C) excavation of the neoplasm, and (D) metastases (intrathoracic).

(A) *Pleural Effusion*.—The presence of

a hydrothorax is so frequently encountered in carcinoma of the lung that in a patient of cancer age and, in the absence of a previous cardiac, nephritic, or pneumonic process, it should always be looked upon with a suspicion of being the result of an underlying malignancy, until proven otherwise. There is nothing unusual in the roentgenographic appearance of an effusion due to a malignancy of the lung, except, perhaps, that the position of the mediastinum is generally unaffected by the fluid (Fig. 14). The mediastinum usually remains in a relatively normal position and is not displaced as it is in the case of a pleural effusion following an acute inflammatory process. Butler and Ritvo believe that the upper limit of the fluid generally describes a curvilinear line extending upward toward the axillary region. This phenomenon is more often encountered in effusions secondary to the parenchymal neoplasm than in the other forms. The density of the shadow cast by the fluid will vary with the thickness of the layer of fluid present. Various degrees of obliteration of cardiac, pulmonary, and diaphragmatic detail may also be observed. Not infrequently, in the early hilar and parenchymal types of neoplasm, the fluid present is of such small quantity that it is entirely confined to the costophrenic angle. As the disease progresses, the lateral hemithoracic and apical regions remain relatively clear, whereas, the central and hilar areas become more opaque. This may be due to the fact that the lateral and apical parts of the thorax are least involved in the reactionary pleuritis. The adhesions resulting from the pleuritis further tend to limit the extent of the effusion. It has been pointed out by Kirklin, that fluid in the pleural cavity is more commonly encountered in those cases in which the carcinoma originates in the lower lobes than in the upper lobes.

In the hilar cases, pleural effusion is usually a late manifestation of the disease and may be accompanied by some contraction of the hemithorax. In those cases in which there is bronchial obstruction

The roentgenographic appearance of a gone excavation is characteristic. The carcinoma of the lung which has under- vomica is thick-walled and irregularly



Fig. 17 (*upper left*). Excavated carcinoma of the right upper lobe. There is considerable infiltration about the neoplasm. The cavity contains several thickened polypoid processes.

Fig. 18 (*upper right*). Same case as shown in Figure 17, lateral view. In addition to the findings noted in Figure 17, there is a fluid level present within the cavity.

Fig. 19 (*lower left*). Carcinomatous pneumonitis of both lungs, more pronounced on the right side.

Fig. 20 (*lower right*). Obstruction of the left main bronchus which is complete in the lower lobe. There is a crescentic dense shadow at the left hilus and bronchiectatic areas at the left base. There is an abrupt cessation to the flow of the contrast medium at the beginning of the left lower lobe bronchus.

infiltrated (Figs. 17 and 18). Extending outward from the cavity and into the surrounding lung tissue, there are strands of carcinomatous and inflammatory projections, while extending into the cavity proper there are irregular short processes which appear like foreshortened stalactites and stalagmites. Within the cavity there may be one or more fluid levels. The bronchus leading to the cavity is usually densely infiltrated and appears to end in a unilateral group of enlarged hilar or mediastinal glands.

(D) *Metastases (Intrathoracic)*.—Regardless of the duration, size, or position of the primary growth, metastasis may occur at any time during the course of the disease. Roentgenologically, we can distinguish three sites of metastatic deposits: (1) In the lungs and pleura; (2) in the bony framework, and (3) in the heart and pericardium.

(1) Metastatic deposits in the lung appear as discrete opaque nodules in the region of the mother growth or may be widespread throughout the same lung and/or contralateral lung. When generalized, it has the appearance of a miliary pulmonary carcinosis. On the roentgenogram there are numerous, various-sized, round, discrete, opaque shadows scattered throughout the lung-fields. Frequently these deposits appear like a diffuse irregular infiltration of the lung. Lorey describes a case of miliary carcinosis, due to erosion of a pulmonary vessel, with subsequent hematogeneous spread of the disease throughout both lungs. Metastasis to the pleura is almost always associated with pleural effusion. When the fluid is removed one may observe round dense areas of opacity, irregularly distributed on the surface of the pleura. (2) Secondary deposits in the ribs, clavicles, sternum, and vertebræ are frequently encountered. These structures show areas of rarefaction and at times pathologic fractures. (3) Metastasis to the heart (pericardium) is evidenced by a collection of fluid in the pericardial sac, which is indicated on the roentgenogram by an ob-

literation of the normal cardiac configuration.

Schwartz and Auerbach have pointed out that there are instances of bronchogenic malignancies in which a "carcinomatous pneumonia" takes place (Fig. 19). They show cases in which the bronchus apparently presented no evidence of carcinoma but in which there were many solid foci filling the alveolar spaces and perivascular lymphatics. Microscopic examination of representative tissue showed a squamous-cell carcinoma.

The above classification is simply a means of identification of the site of origin and mode of spread of a primary cancer of the lung. It must not be construed that these forms remain distinct, for they do not. The parenchymal tumor may involve by extension the hilum and pleura, simulating a malignant growth which has arisen from either of these latter sites and which has progressed. Likewise, may the other forms extend and simulate one another.

As a further aid in the diagnosis, we may resort to the accessory roentgenological methods, such as bronchography and pneumothorax. The judicious instillation of lipiodol into the bronchial tree is frequently of inestimable value in the diagnosis of bronchogenic malignancy. Bronchographic studies readily portray alterations in the caliber of the bronchial lumen as well as the site of the bronchial obstruction (Figs. 20 and 21). On the roentgenogram an intrabronchial growth causing complete obstruction is denoted by an abrupt cessation of the flow of the contrast medium. At the point of the obstruction the radiopaque material is usually collected in a dilated bronchial pocket, the distal part of which is irregular and niched. At times, and in those cases in which there is an incomplete bronchostenosis, the contrast substance may enter the bronchus and assume a "rat-tail"-like narrowing. In other instances, and in those cases in which there is an infiltration in the wall of the bronchus, the bronchial wall is outlined unevenly and at the site of

the neoplasm there is a filling defect or a niche. Pruvost and Quenu, having encountered difficulty in introducing contrast material into pulmonary cavities *via* the bronchus, advised its direct introduc-

pleura, the separation of the pleura and the contrast effect of the pneumothorax will aid in the localization of the pathologic process (Fig. 22).

In the foregoing statements an attempt



Fig. 21.

Fig. 21. Same case as shown in Figure 20, lateral view of the thorax. There is a pooling of the radiopaque substance in the dilated left main bronchus.

Fig. 22. Induced pneumothorax revealing a carcinoma of the lung previously not manifest because of the surrounding normal lung tissue.



Fig. 22.

tion through the chest wall, transpleurally. This procedure can be used to outline cancerous cavities, but is not without some degree of danger. Recently, Coryllos and Ornstein have used this method to outline tuberculous cavities, in which cases the bronchus leading to the cavity was obstructed. Artificial pneumothorax is another roentgenologic diagnostic aid. By partially collapsing the lung one may be able to differentiate between an intrapulmonary and an extrapulmonary tumor. By replacing a pleural effusion with air or gas, a neoplasm previously obscured by the fluid may become visible. In the case of a peripheral neoplasm, which cannot be differentiated from a localized collection of fluid, or in the case of a carcinomatous lymphangitis of the

has been made to correlate the intrathoracic pathologic changes associated with a carcinoma of the lung and the ensuing roentgenographic findings. It is important to recognize the fact that the shadow seen on the roentgenogram is not entirely due to the neoplasm but is partly contributed to by the surrounding lymphangitis and pneumonitis. The diagnosis of carcinoma of the lung (from roentgenographic studies) is dependent upon the recognition of these changes. In the later stages the various forms of carcinoma of the lung will so closely simulate each other that a differentiation between them will not be possible. Nor does it matter whether or not one is able to make this differentiation at this late stage. What does matter is the early recognition of the

disease. If carcinoma of the lung is to be diagnosed at a time when it will still be amenable to some therapeutic measure, it must be recognized earlier. To this end, one should not be satisfied with a simple anteroposterior or a postero-anterior roentgenographic examination of the thorax. Roentgenograms should be taken in every direction possible. Often lateral, oblique, and Bucky exposures will be necessary to give the desired information as to the presence of a neoplasm, its size and location, and whether or not it has spread. In addition, such roentgenograms should be taken during inspiration and during expiration. An obstructive emphysema with mediastinal displacement during respiration is pathognomonic of bronchial obstruction, even though the surrounding lung tissue is apparently "normal." In some clinics stereoscopic and tomographic studies have been employed in an attempt at an earlier recognition of pulmonary carcinomas. It is beyond the scope of this communication to discuss these latter procedures.

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REFERENCES

- (1) ASSMANN, H.: Zur Frage der Pathogenese und zur klinik des Bronchialkarzinoms. *Med. Klinik*, 20, 1796-1799, January, 1924.
- (2) BUTLER, P. F., and RITVO, M.: Primary Carcinoma of the Lung: Diagnosis and Treatment by X-ray. *New England Jour. Med.*, 207, 435-443, Sept. 8, 1932.
- (3) CARMAN, R. D.: Primary Cancer of the Lung. *Med. Clin. North America*, 5, 307-354, 1921.
- (4) CLARKE, B. E.: Superior Pulmonary Sulcus Tumor (Pancoast). *Am. Jour. Path.*, 10, 693, 1934.
- (5) CORYLLOS, P. N., and ORNSTEIN, G. G.: Giant Tuberculous Cavities of the Lung. *Jour. Thoracic Surg.*, 8, 10-54, 1938.
- (6) FARIÑAS, P. L.: Serial Bronchography in Early Diagnosis of Bronchial Carcinoma. *Am. Jour. Roentgenol. and Rad. Ther.*, 32, 757-762, December, 1934.
- (7) GRAEF, I., and STEINBERG, I.: Superior Pulmonary Sulcus Tumor. *Am. Jour. Roentgenol. and Rad. Ther.*, 36, 293-300, September, 1936.
- (8) HIRSCH, I. SETH: The Roentgen Diagnosis of Malignant Neoplasms of the Lung. *RADIOLOGY*, 9, 470-496, December, 1927.
- (9) HOCHBERG, LEW A., and LEDERER, M.: The Early Manifestations of Primary Carcinoma of the Lung. *Arch. Int. Med.*, 63, 80-99, January, 1939.
- (10) HYDE, T. L., and HOLMES, G. W.: The Roentgenological Aspects of Primary Tumors of the Lung. *Am. Jour. Roentgenol. and Rad. Ther.*, 18, 235-243, 1927.
- (11) JACOX, H. W.: Superior Pulmonary Sulcus Tumor. *Jour. Am. Med. Assn.*, 103, 84-87, July 14, 1934.
- (12) KIRKLIN, B. R.: Roentgenological Signs and Differential Diagnosis of the Principal Malignant Diseases of the Lungs and Mediastinum. *Wisconsin Med. Jour.*, 31, 95-99, February, 1932.
- (13) LOREY, A.: Die Akute Miliartuberkulose im Röntgenbild. *Ergebn. d. med. Strahlenforsch.*, 1, 131-144, 1925.
- (14) OTTEN, M.: Die Röntgendiagnose der Lungengeschwulste. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 15, 1-31, 1910.
- (15) PANCOAST, H. K.: Superior Pulmonary Sulcus Tumor. *Jour. Am. Med. Assn.*, 99, 1391-1396, Oct. 22, 1932.
- (16) PRUVOST, P., and QUENU, J.: L'exploration des grands abcès pulmonaires par l'injection trans-pariétale de lipiodol. *Presse med.*, 45, 1397-1400, Oct. 2, 1937.
- (17) RABIN, C. B., and NEUHOF, H.: A Topographic Classification of Primary Cancer of the Lung. Its Application to the Operative Indications and Treatment. *Jour. Thoracic Surg.*, 4, 147-164, December, 1934.
- (18) REISNER, D.: Carcinomatous Cavities of the Lung. *Quart. Bull. Sea View Hosp.*, 1, 322-336, April, 1936.
- (19) SCHWARTZ, S., and AUERBACH, O.: Non-tuberculous Pulmonary Disease Simulating Pulmonary Tuberculosis. *Quart. Bull. Sea View Hosp.*, 4, 95-118, 1938.
- (20) STIVELMAN, B. P.: The Roentgen Ray in the Diagnosis of Primary Pulmonary Neoplasm. *Jour. Am. Med. Assn.*, 91, 1690-1694, Dec. 1, 1928.
- (21) TOVELL, H. M.: X-ray Findings in Primary Carcinoma of the Lung. *Canad. Med. Assn. Jour.*, 15, 485-489, 1925.
- (22) TUTTLE, W. M., and WOMACK, N. A.: Bronchogenic Carcinoma: A Classification in Relation to Treatment and Prognosis. *Jour. Thoracic Surg.*, 4, 125-146, December, 1934.
- (23) VINSON, P. P., MOERSCH, H. J., and KIRKLIN, B. R.: Value of Bronchoscopy in Diagnosis of Malignant Conditions of the Lungs. *Jour. Am. Med. Assn.*, 91, 1439-1443, Nov. 10, 1928.
- (24) WASCH, M. G., and EPSTEIN, B. S.: Bronchogenic Carcinoma: Analysis of 54 Cases with Roentgenological Classification. *Am. Jour. Med. Sci.*, 190, 362-371, September, 1935.

A ROENTGENOLOGIC CONSIDERATION OF GASTRITIS¹

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RECENTLY there has been a noticeable increase of interest in the roentgenologic diagnosis of gastritis. From the present knowledge deduced from the gastroscopic and radiologic studies, the roentgenologist has been greatly aided in recognizing the anatomic appearance of the normal and abnormal picture of the gastric mucosa. Although the gastroscopic method of examination stands pre-eminently as the procedure of choice in the diagnosis of gastritis, it is a complementary procedure that is difficult to utilize as a routine measure. This communication is primarily concerned with the radiologic report of the different forms of gastritis, with a presentation of five cases which roentgenologically simulate carcinoma of the stomach.

Gastritis has long been recognized from autopsy and surgical specimens. The histologic studies of surgical specimens stimulated interest in this pathologic entity. However, not until the gastro-scope became fully developed, was the true nature of the different forms of gastritis recognized in the living subject.

In the more recent literature, the following authors have contributed to this subject, namely, Darling; Prévôt; Larimore; Simpson; Ansprenger and Kirklin; Schindler and others; Holmes and Schatzki; Benedict; Monaghan, Bockus, and others; Stix, and others.

The frequency of gastritis has not as yet been fully established. There can be no question that certain forms of gastritis, such as the superficial variety, occur with great frequency. Most of these, however, heal spontaneously. On the other hand, comparatively few cases become chronic.

The superficial forms of gastritis may be disclosed only by gastroscopic studies, while the more chronic forms may be recognized by both the gastroscope and roentgen methods of examination.

Heretofore, there have been few statistical studies to determine the incidence of gastritis. Recently, the frequency of gastritis has been determined by means of routine gastroscopic examinations. Schindler and his co-workers have examined 2,500 cases gastroscopically, found that 23 per cent were normal and approximately 50 per cent presented mucosal changes representing a chronic inflammatory process. The percentage of cases of gastritis seems to be rather high in his series. It is more probable that in the routine examinations the percentage of gastritis cases will prove to be much lower than reported.

The etiology of gastritis varies considerably. It may be due to the following causes: mechanical; chemical; infectious; bacterial; allergic; post-operative, etc. According to Darling and other authors, alcohol is an exceedingly important factor, giving rise to a classical form of chronic gastritis. Lead poisoning and other corrosive substances also produce gastritis.

Age and Sex Incidence.—Gastritis is most frequently observed in adults between the third and sixth decades. Its incidence increases with advancing years. It is of interest to note that males predominate in cases of hypertrophic gastritis. On the other hand, in the superficial mucosal variety the sex incidence is more evenly distributed.

Classification.—Numerous classifications have been formulated for the study of this condition. A simple classification based upon gross anatomical changes is more desirable for diagnostic purposes.

¹ Presented before the Twenty-fourth Annual Meeting of the Radiological Society of North America, at Pittsburgh, Nov. 28-Dec. 2, 1938.

The following classification may be used in the study of gastritis:

significance only when the furrows bet^{relief} them are widened, accompanied by a reduc^{of}

- | | | |
|----------------------------|---|---|
| (1) Simple | { | Superficial |
| | | Erosive |
| | | Hemorrhagic |
| | | Follicular |
| | | Membranous |
| (2) Hypertrophic | { | Superficial |
| | | Localized (involving all coats) |
| | | Diffuse (linitis plastica type) |
| (3) Ulcerative | { | Ulcerative { Simple, in peptic ulceration |
| | | { Hypertrophic |
| | { | Corrosive { Superficial |
| | | { Hypertrophic |
| (4) Atrophic | | |
| (5) Phlegmonous | | |

In recent years great strides have been made in understanding the variable pathologic states of the different forms of gastritis. The pathologic picture depends in a great measure upon the variety of inflammatory changes encountered, and the depth of the diseased process.

In the superficial mucosal form, the mucosa is reddened and slightly swollen; there may or may not be superficial erosions. It may be localized or diffuse. The erosions may at times be recognized as small flecks of opaque medium, which are temporarily held by the ulcerated surface. The superficial forms ordinarily cannot be recognized by roentgen studies.

Hypertrophic gastritis produces a characteristic picture. The mucous membrane is swollen and thickened. The rugæ are thickened, elevated, broadened, rigid, and show alteration of form and shape, becoming tortuous and irregular. The hyperplasia of the mucosa produces a granular appearance, which is pathognomonic of hypertrophic gastritis. In the more advanced cases, the picture resembles one of a polyposis. Multiple erosions are not uncommon. Reynberg points out that the increase in the caliber of the folds is of

tion in the number of folds. The rigidity of the folds is persistent on repeated examination and cannot be erased by manipulation or pressure. It is also noteworthy to point out that the serrations along the greater curvature, which are often seen in the normal case, are markedly exaggerated in cases of hypertrophic gastritis. The condition may be localized or diffuse. The localized variety often resembles a gastric neoplasm.

Simple ulcerative gastritis is commonly seen in gastric ulceration. It is usually localized in the area surrounding the ulcer. It is recognized roentgenologically as a localized indurated area produced by thickening and swelling of the tissues.

Ulcerative hypertrophic gastritis is an extremely rare form of this affection. It resembles carcinoma, from which it is difficult to differentiate. It is often possible to demonstrate a benign ulcer niche defect on the lesser curvature. The wall of the stomach is greatly thickened, producing a neoplastic type of defect. The inflammatory mass can be felt to roll under the palpating hand in the fluoroscopic examination. The mucosal folds are markedly thickened, reduced in number but

ated. Two examples of gastritis are presented. The first is portrayed by a lumen to the form of a funnel toward the pylorus. Scar retraction often leads to stenosis and pipe-like deformities of the



Fig. 1. A case of simple hypertrophic gastritis.



Fig. 2. An ulcerative hypertrophic gastritis is shown. Note the niche defect at arrow A, and the marked deformity which simulates a carcinoma.

flattening of the folds, giving the picture of a smooth mucosal surface, devoid of mucosal markings. The mucous membrane and the entire gastric wall is atrophic and thinned out.

Phlegmonous gastritis chiefly involves the submucosa, which becomes markedly thickened and when cut shows a purulent material exuding from it. The condition is comparatively rare. It may be localized or diffuse. Roentgenologically it is recognized by a diminution in the size of the stomach. It tends to encircle the whole circumference of the gastric wall, producing the picture of linitis plastica. The mucosal folds show evidence of hypertrophy and in advanced cases may be partially or completely obliterated.

In corrosive gastritis, all degrees of inflammation may be observed, ranging from superficial hemorrhagic necrotic areas to a marked shrinking of the whole stomach due to contraction and thickening. The lesser curvature usually reveals a more extensive process than the greater curvature, especially in the pyloric portion. In this condition the roentgen examination shows a rigid, markedly swollen mucosa, which reduces the size of the gastric

pylorus. The stomach is often markedly reduced in size. In more severe cases, the condition may be complicated by perforation and phlegmon. Giuntoli reports a case in a youth who swallowed a dilute solution of sulphuric acid, in which he found a stenosis of the pylorus and an ulcerous enteritis with stenosis.

Post-operative gastritis is a common complication following gastro-enterostomy. According to Reynberg, gastro-enterostomy is regularly followed by a chronic gastritis, which appears soon after the operation.

Allergic gastritis is probably more common than a survey of the literature would indicate. In this condition there are superficial changes in the mucosa in the form of redness and swelling. Its recognition by means of the roentgen ray is most difficult to disclose; however, the condition has been roentgenologically recognized by Hansen and Simonsen, who describe two cases. They noted that after a usual barium meal the gastric rugæ appeared normal, but on re-examination after an egg-yolk or milk containing barium, the gastric rugæ were widened, which, according to these authors, indicated a "hyperergic" gastritis.

They also found a co-existing pylorospasm in both cases.

The diagnosis of gastritis by means of

pointed out that a normal mucosal relief may be demonstrated in certain cases of gastritis.



Fig. 3.



Fig. 4.

Fig. 3. An extensive ulcerating gastritis is demonstrated. Note the ulcer defect on lesser curvature at arrow A. The rugae are not entirely obliterated, but can be seen in the prepylorus.

Fig. 4. The linitis plastica type of stomach, in a case of gastritis.

the roentgen ray frequently presents many difficulties. The varying degree of involvement and the different forms of gastritis produce different roentgenologic pictures, which often require much consideration and a thorough knowledge of the pathologic process, together with all clinical data, in order to make a correct diagnosis. Our interest has been chiefly centered in the hypertrophic mucosal and atrophic forms. Increasing experience in the portrayal of roentgenologic findings in other forms of gastritis has aided us in more accurately diagnosing these conditions.

Attention, however, must be directed to the fact that the diagnosis of gastritis may be eluded by this means of examination. The principal disadvantage of the x-ray is its failure to disclose evidence of gastritis in all cases. It must also be

Normally, the gastric rugae run parallel along the lesser curvature. On the greater curvature they are arranged obliquely. In the fundus there are numerous circular rugae, but in the pyloric portion they usually run parallel to both curvatures and no circular rugae are present. The elastic autoplasmic behavior of the gastric mucosal folds can be demonstrated by means of the roentgen ray. Their course, size, thickness, height, and space between the folds may be clearly demonstrated in the normal stomach.

In gastritis, however, distinct changes in the normal picture of the mucosal folds are readily disclosed. The radiologist must acquire experience in recognizing and interpreting these changes in order to diagnose cases of gastritis.

Five interesting cases are presented to

illustrate the varying roentgen views observed in different forms of gastritis. Case 1 (Fig. 1) illustrates localized hyper-

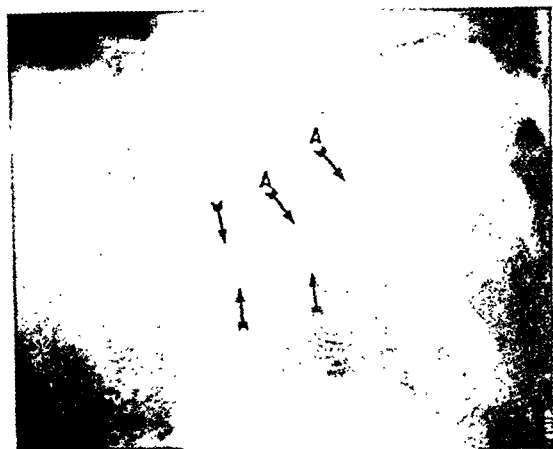


Fig. 5. A case of corrosive gastritis, simulating carcinoma. Note the ulcer niche defects at arrows A. The entire stomach is markedly reduced in size, the reduction being most marked in the pyloric half.

trophic changes of the gastric mucosa, localized in the prepylorus. The folds were rigid, could not be erased by pressure, and the spaces between them were broadened. In Case 2 (Fig. 2) a large irregular annular filling defect is shown at the prepylorus. A small ulcer niche can also be seen on the posterior wall. The entire wall is markedly thickened in the involved area. The defect simulates a carcinoma. At operation the case proved to be an ulcerating gastritis. An extensive irregular filling defect is shown in Case 3 (Fig. 3) involving the pyloric half of the stomach. Also, a large ulceration is seen on the lesser curvature. The large defect resembled a carcinoma. At operation a large, ulcerating, indurated, thickened gastric wall was found. Case 4 (Fig. 4) illustrates a case of alcoholic gastritis, producing a diffuse contraction of the stomach simulating a linitis plastica. The entire stomach is involved. Note the smooth contour of the gastric curvatures and the rapid emptying in the immediate film. Case 5 (Fig. 5) demonstrates a case of corrosive gastritis, after swallowing formaldehyde.

Note the small contracted stomach and the pipe-like deformity of the pylorus. Also notice the two ulcerated areas on the lesser curvature (at arrows). At operation a markedly thickened gastric wall was found, involving the entire stomach. The changes were especially marked in the pyloric portion.

SUMMARY

The roentgenologic criteria of the different forms of gastritis are presented. The difficulties encountered in recognizing the condition are emphasized. Five illustrations are shown, demonstrating interesting cases of different forms of gastritis. The diagnosis of certain forms of gastritis cannot be made without considering all clinical data.

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REFERENCES

- (1) ANSPRENGER, A., and KIRKLIN, B. R.: Roentgenologic Aspects of Chronic Gastritis: Critical Analysis. *Am. Jour. Roentgenol. and Rad. Ther.*, 38, 533-541, October, 1937.
- (2) BENEDICT, E. B.: Chronic Gastritis: Clinical Discussion Based on Gastroscopic Examination. *New England Jour. Med.*, 212, 468-472, March 14, 1935.
- (3) DARLING, H. C. R.: Chronic Gastritis. *Med. Jour. Australia*, 2, 45-50, July 11, 1936.
- (4) FINK, H.: Phlegmonous Gastritis. *Am. Jour. Surg.*, 35, 599-602, March, 1937.
- (5) GIUNTOLI, L.: Gastrite tossica segmentaria dell'antro. *Radiol. med.*, 17, 853-856, July, 1930.
- (6) HANSEN, K., and SIMONSEN, M.: Röntgenologische Beobachtung und Darstellung der allergischen Gastritis und des allergischen Pylorospasmus. *Röntgenpraxis*, 9, 145-151, March, 1937.
- (7) HOLMES, G. W., and SCHATZKI, R.: Examination of Mucosal Relief as Diagnostic Aid in Diseases of Gastro-intestinal Tract. *Am. Jour. Roentgenol. and Rad. Ther.*, 34, 145-157, August, 1935.
- (8) LARIMORE, J. W.: The Significance of Chronic Gastritis. *Am. Jour. Digest. Dis.*, 3, 215-220, June, 1936.
- (9) MONAGHAN, J. F., BOCKUS, H. L., KORNBLUM, K., and MOFFITT, G. R.: Gastric Secretory Behavior in Chronic Gastritis. *Am. Jour. Digest. Dis.*, 3, 655-666, November, 1936.
- (10) PRÉVÔT, R.: Zur Röntgendiagnostik der Ätzgastritis. *Röntgenpraxis*, 8, 372-375, June, 1936.
- (11) REYNBERG, S. A.: Value of Roentgen Examination in Diagnosis of Chronic Gastritis. *Sovet. vrach. gaz.*, 16, 1267-1276, Aug. 30, 1935.
- (12) SCHINDLER, R., ORTMAYER, M., and RENSHAW, J. F.: Chronic Gastritis. *Jour. Am. Med. Assn.*, 108, 465-468, Feb. 6, 1937.
- (12-a) Idem: Clinical Symptoms of Chronic Gastritis: Observations on 35 Selected Cases. *Arch. Int. Med.*, 60, 143-153, July, 1937.
- (13) SCHINDLER, R., and ORTMAYER, M.: Classification of Chronic Gastritis with Special Reference to

the Gastrosopic Method. Arch. Int. Med., 57, 959-978, May, 1936.

(14) SIMPSON, C. KEITH: Observations upon Gastritis. Guy's Hosp. Rep., 85, 102-125, January, 1935.

(15) STIX, W. H.: Chronic Gastritis. Jour. Med., 17, 336-341, September, 1936.

DISCUSSION

B. A. RHINEHART, M.D. (Little Rock, Arkansas): I enjoyed Dr. Feldman's paper very much. I have a great respect for Dr. Feldman and Dr. Friedenwald because I have had occasion to quote several of their articles.

This paper reminds me of a statement of Alvarez that we should not be satisfied with pointing out beautiful morphological defects: we should get at the cause.

I believe that probably some day chronic gastritis will be shown to belong to that large group of diseases which we may class as degenerative diseases and which has been explored to a very slight extent so far. The pointing out of these morphological defects does not give us the cause. We may hold back research on such conditions by continuously examining these things by the x-ray and by the gastroscope.

If the cytological pathology of these lesions is examined carefully under the microscope, it will be seen to correspond very closely to what the experimental physiologists have found occurring in laboratory animals which have been kept on vitamin-deficient diets. The deficiencies of vitamin A, for instance, have promoted sloughing of epithelium in the gastro-intestinal tract. Deficiencies of vitamin B have promoted not only sloughing of the epithelium but hemorrhage into the mucosa, into the submucosa, and hemorrhage and fragmentation into the muscles with, of course, chronic changes. Deficiencies of vitamin C have caused a loss of cement substances between the cells with practically the same changes that vitamin B exhibits.

Naturally, any such lesion—duodenal ulcer, for instance—has a tendency to heal. Winkelstein has shown what causes duodenal ulcer and that even in the case of

removal of the parathyroid glands duodenal ulcer will heal, but it heals slowly, so we may expect in lesions such as this that healing will be going on at the same time that ulceration goes on.

I think that in the future, probably when this subject is attacked from the nutritional standpoint, we shall begin to find out what is causing these conditions and what the cure is.

MAURICE FELDMAN, M.D. (*closing*): I wish to thank Dr. Cole¹ and Dr. Rhinehart for their discussions of my paper.

In the presentation of this paper, I have shown the various types of gastritis that one finds in the roentgen examination; I emphasized that it takes considerable experience to diagnose these conditions, and pointed out that the clinical observations are very important, because without consideration of the clinical and gastroscopic findings we cannot always make a diagnosis of gastritis.

In the two interesting cases of ulcerative gastritis, a markedly thickened gastric wall was found at operation—the gastric wall was about an inch and a half thick at the point of involvement. Histologic studies were made in both cases and hypertrophy of all the coats of the stomach was seen grossly and on microscopic examination. Definite gastritic changes were noted in both cases; although they simulated carcinoma, they proved to be cases of ulcerated gastritis.

The roentgen diagnoses of the two cases mentioned are exceedingly difficult to make without the clinical findings, and from the x-ray alone one would be readily misled. The films of both cases were seen by other roentgenologists and were diagnosed as carcinoma.

In the examination of the patient, by combining the history and the x-ray findings, a diagnosis of a benign lesion of an ulcerating gastritis type was made.

Regarding the hypertrophy of the lymph follicles, in my classification I placed this form under the type of follicular gastritis,

¹ Not returned for publication.

a form of gastritis which is impossible to diagnose by the x-ray. Mention was made of this form of gastritis in the classification because of anatomic changes.

As to the cause of gastritis which Dr. Rhinehart has pointed out, in many cases we cannot tell the cause unless a thorough history is taken of the case, but on the whole the etiology of gastritis has not been entirely explored. The cases that I pre-

sent are specific types of gastritis; they are cases of gastritis of which we know the cause. Those of ulcerative gastritis were purely of inflammatory nature, and in the other cases a specific type of gastritis is shown.

As I mentioned in my paper, there are many different forms of gastritis and one has to be very careful in the diagnosis and classification of this disease.

NEW DEVICES

A SIMPLE APPARATUS FOR VISUALIZATION OF SINUS TRACTS¹

By LEONARD LONG, M.D., Resident in Radiology, University of Wisconsin Medical School, Madison, Wisconsin

From the Department of Radiology and Physical Therapy, State of Wisconsin General Hospital, Madison.

One of the problems often faced by the roentgenologist is the visualization of draining sinus tracts. Treatment of these cases often presents an even greater problem to the surgeon, if he does not know the extent and communications of the tract.

The method usually followed, to fill larger

soon apparent to anyone who tries them. The most important causes of failure are:

(1) Many tracts are so crooked that a catheter cannot be inserted into them even though their size seems adequate.

(2) The contrast solution often flows back toward the surface between the catheter and the sinus wall and escapes at the mouth of the sinus without outlining any of the tract beyond the tip of the catheter.

(3) Attempts to introduce a cannula or blunt needle into a very small tract, the direction of which one does not know, causes trauma and pain and sometimes results in the deposit of

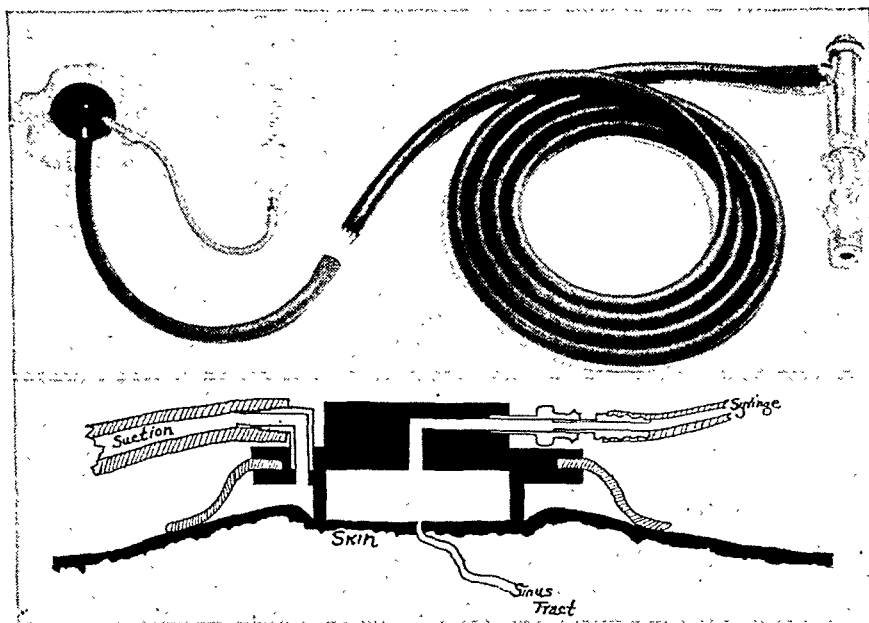


Fig. 1 (above). A shallow cup is connected by a small tube to a syringe filled with contrast solution. The cup is surrounded by a flange and rubber disc which form a vacuum chamber. An ordinary water vacuum pump is connected to this chamber by heavy-walled vacuum tubing.

Fig. 2 (below). Cross-section of the apparatus showing the central cup on the skin over the mouth of the sinus tract. The skin is pulled up around its edges by vacuum in the surrounding chamber, sealing it, and forming a direct path from the syringe to the sinus.

sinus tracts with contrast solution, is through the use of a rubber catheter inserted into it. For small tracts, in which a catheter cannot be inserted, a blunt needle or small cannula is sometimes used with success.

The deficiencies of both these methods are

the contrast solution in the subcutaneous tissues.

(4) It is very difficult to keep the solution from draining out before the patient can be properly positioned and films exposed. The contrast solution which has leaked onto the skin surface obscures the tract and many times

¹ Read before the general staff meeting, Jan. 17, 1939.

is confusing in interpretation, especially in single films.

(5) If the injection is made under fluoroscopic control, as it should be whenever possible, the catheter or cannula is easily displaced

about an inch wide, which form a shallow vacuum chamber around the cup. The central cup and the surrounding chamber open to the outside through separate outlets so designed that rubber tubes can be connected to them.

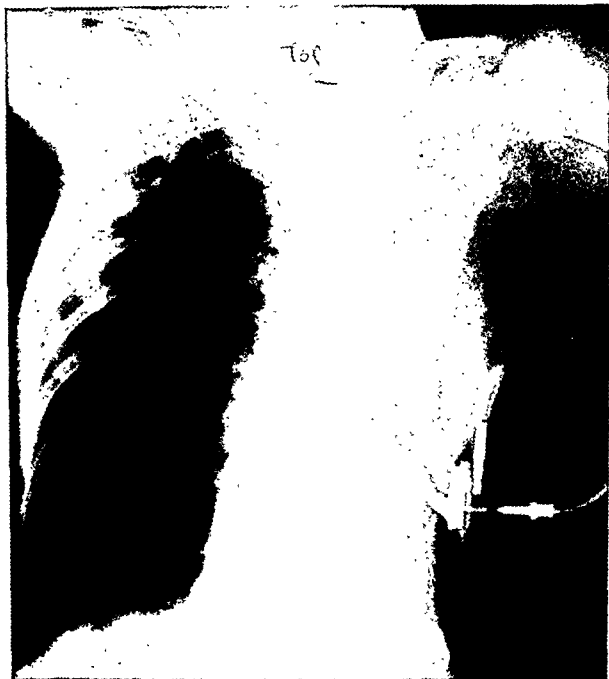


Fig. 3.

Fig. 3. Roentgenogram showing a sinus tract residual from a thoracoplasty injected by means of this apparatus. Note how effectively the solution is sealed in the cup at the mouth of the sinus.



Fig. 4.

Fig. 4. A small and crooked sinus tract which other methods had failed to fill satisfactorily. Note that a little of the contrast solution has leaked into the vacuum chamber because excessive pressure was used after the tract had been completely filled. Being readily observed at fluoroscopy, the injection was then stopped and the overflow automatically carried away by the suction. Thus no excess was left on the skin to obscure the roentgenogram.

in rotating the patient for proper visualization in the different positions.

(6) More time is usually consumed in preparing for the injection than in the procedure itself and this not only takes up the operator's time but ties up the fluoroscopic room.

All of these factors, together with the mediocre results so often obtained, cause this valuable diagnostic procedure to be neglected. We therefore devised a very simple but effective apparatus for this purpose which has been found to overcome all the difficulties enumerated and makes the injection of a sinus tract almost as simple as administering a barium enema. The essential part of the apparatus was made by our mechanic, Mr. J. N. Hipple.

The apparatus consists of a small shallow cup about one-half inch in diameter which fits over the mouth of the sinus tract. This is surrounded by a flange and a soft rubber disc,

Accessories consist of an ordinary water vacuum pump, a length of vacuum tubing, a syringe for contrast solution, and a small tube fitted with adaptors for connecting the syringe to the cup.

In operation, the patient is placed on the fluoroscopic table and the operator and assistant allow their eyes to become accommodated. The vacuum chamber outlet is then connected by a sufficient length of heavy-walled vacuum tubing to an ordinary water vacuum pump on the nearest tap. The central cup is then placed directly over the mouth of the sinus tract and the pump started. As the space under the rubber disc is evacuated the skin is pulled up snugly around the rim of the central cup, which is thereby sealed off. By a length of ordinary catheter tubing fitted with proper adaptors the syringe containing the contrast solution is now connected to the cup. The injection is made

under fluoroscopic control and the patient can be rotated freely to demonstrate to best advantage the direction and communications of the tract. When the filling is complete the syringe tube is closed off with a small clamp and the syringe removed. The vacuum is left on. The patient is then placed in the position found by fluoroscopy to demonstrate best the tract, and films are taken. Stereoscopic films are a decided advantage. The vacuum is now turned off, the cup drops off, and the solution runs out.

The tube connecting the syringe to the cup should be filled with the solution before connecting it to the cup in order to prevent trapping of air ahead of the contrast solution in the sinus tract.

A helpful but not absolutely necessary additional item is an elastic band which is passed around the body or extremity and over the cup to counteract the drag of the vacuum tubing and prevent accidental dislodgment of the cup during rotation of the patient in the dark.

The amount of pressure which can be used in the injection obviously is proportionate to the amount of vacuum holding the cup in place. No more injury to the skin than a slight ecchymosis has ever been observed following the use of this apparatus. It is conceivable, however, that more powerful vacuum pumps might produce injury and this should be carefully checked by experiment before use.

When very long sinus tracts, with many ramifications, are to be injected, it may be desirable to use the gravity method instead of a syringe and to allow a considerable time for the solution to reach all parts.

The apparatus is made of hard rubber, with the soft rubber disc cemented in place. It is sterilized by boiling. The tube connectors are placed at the edge in order to keep the cup flat and allow placing the part as near as possible

to the film for the best radiographs. Being radiolucent (except the two small metal tube connectors), it does not obscure the sinus tract.

The ordinary water vacuum pump is recommended because most x-ray departments have a tap in or very near the fluoroscopic room.

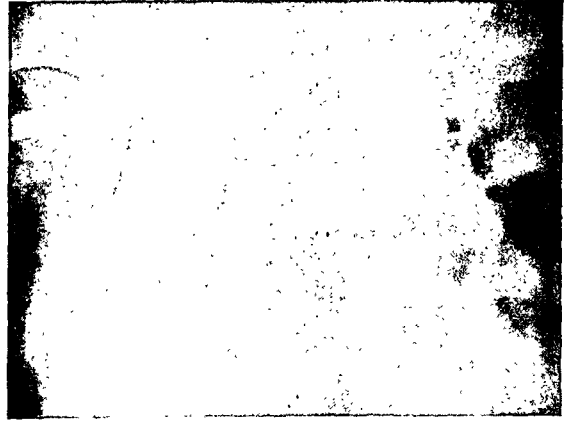


Fig. 5. Injection of biliary fistula showing perfect filling of the biliary system by means of this apparatus.

Also this type of pump is inexpensive and easily obtained. Other vacuum sources can, of course, be used if the vacuum is sustained and can be regulated. Some type of vacuum-measuring instrument is needed if the vacuum cannot be depended upon to remain at the optimum level.

The dimensions as given here are satisfactory for most cases. The same method could be used for extremely large openings, such as a colostomy, if a large cup were constructed. The rubber disc makes it possible to adapt the apparatus to rounded surfaces by merely molding the disc by hand until the vacuum has been established.

POINTS OF INTEREST

In drawing up plans for state-wide group hospitalization in Michigan, the following definition was established by the Michigan State Medical Society and the Michigan Hospital Association:

"It is agreed that the professional services of a doctor of medicine shall not be included in group hospital service programs. Technical services may be rendered as hereinafter defined: Technical services, in connection with hospital and medical service plans, are not considered professional medical services unless rendered directly by a doctor of medicine. Notwithstanding the above definition, it is agreed that the hospital program will not include any x-ray service."

* * *

On February 14 the Board of Trustees of the American Medical Association held a joint meeting in Chicago with representatives of the American Hospital Association. Purpose of the meeting was to seek solutions for some of the conflicts which seem to have developed between the organized hospital world and the organized medical profession in recent years, and to weld a bond of unity between the two allied groups. Resolutions adopted at the close of the meeting provided for similar meetings in the future and gave reason to hope for greater understanding and mutual support between hospitals and the medical profession.

* * *

Associated Hospital Service of New York, the largest group hospitalization plan in the country, and one which includes among its benefits certain medical services as a part of hospital care, suddenly announced a sharp reduction in payments to participating hospitals last month. Payments to hospitals, which formerly amounted to \$15.00 for the first day of hospitalization and \$20.00 for the second day, were reduced to \$11.25 and \$15.00, respectively. It is interesting to observe that the group hospitalization plan in Washington, D. C., which confines its benefits to hospital accommodation as recommended by the American Medical Association, was able last year to decrease its premium by 13 per cent and at the same time increase the number of days of hospital care provided.

The hospital insurance plan in Boston,

which recently added radiology to its benefits with the allegation that mounting reserves warranted the extension of services, found it necessary to reduce its payments at the same time.

* * *

A state cancer hospital, built with WPA and state tax funds, is nearing completion in Columbia, Missouri. It is being built at a cost of \$500,000. Beds will accommodate 90 patients. In addition, a clinic will be provided at the hospital to provide care for ambulatory cases.

* * *

At the request of a special committee of the State Medical Society, the Kansas Board of Medical Registration and Examination asked its attorney for an opinion concerning the right of non-medical practitioners to engage in the practice of radiology, either diagnostic or therapeutic. The following opinion was transmitted to the Board on April 7:

"It is my opinion, based upon a careful study of the statutes and the Supreme Court opinions, that roentgenology, either diagnostic or therapeutic, constitutes a practice of medicine and surgery as defined by the statutes of Kansas. Such practice when carried on by one not licensed to practise medicine and surgery is prohibited and unlawful.

"No rule of your Board can change these provisions of the statutes. Your Board could not, by rule, permit one not licensed as an M.D. to practise either branch of roentgenology, even if such practice was carried on under the direction of an M.D. The Board cannot, by rule, modify a statutory enactment. There may be, and undoubtedly are, certain technical operations connected with the practice of roentgenology that can be carried on by an unlicensed technician. Those operations, of course, could not include diagnostic or therapeutic work."

In consequence of this opinion, the Committee enacted the following resolution which was forwarded to the State Board of Medical Registration and Examination with the request that the Board adopt it as a part of its rules and regulations governing the practice of medicine in Kansas:

"BE IT HEREBY RESOLVED, That roentgenology, both diagnostic and therapeutic, is a specialized and technical branch of the practice of medicine, which in unskilled hands might be dangerous, and while it is recognized

there is a need for lay x-ray technicians as a means of assistance to the physician, these technicians should work only under the direct supervision of a doctor of medicine.

"BE IT FURTHER RESOLVED, That it is the consensus of the committee that all x-ray therapy should be administered under the personal supervision of a doctor of medicine."

* * *

The executive secretary of the Inter-Society Committee attended the regular meeting of the Georgia Radiological Society in Columbus on March 28. The Society adopted a resolution calling upon the Georgia State Medical Society to take stringent action against hospitals in the state which were engaging in the corporate practice of medicine.

Georgia radiologists maintain an active and sustained program in the field of medical economics through their state radiological society. Recently they were successful in securing an amendment to the state cancer law which permits private radiologists to treat state-aid patients. Formerly this work was confined to institutions.

Efforts are now being made to correct the state crippled children's law to provide a method for reimbursing radiologists who perform services on these patients. Fees for radiological services are now included in a *per diem* payment to approved hospitals.

As in other places, Georgia has had its troubles with hospital insurance. Repeated attempts have been made to install a group hospitalization plan which included radiology as a part of hospital care. The state society has not been idle, however, and at the present writing no such plan has been inaugurated. James J. Clark, M.D., is president.

* * *

The Florida Radiological Society held a special meeting on March 19, at Orlando, which was attended by the executive secretary of the Inter-Society Committee for Radiology. The Florida society is an active one and much has been accomplished during the last year or two in protecting and advancing the specialty in that state.

Repeated attempts have been made in several localities to add radiology as a hospital service to group hospitalization plans. Through the efforts of the Florida Radiological Society and with the full support of the county medical societies in the respective communi-

ties, these attempts have been defeated. H. O. Brown, M.D., is president.

* * *

Current reports indicate that the Wagner Health Bill will suffer a painless demise at the hands of the Senate Committee on Education and Labor without ever reaching the Senate floor. A wave of protest from physicians concerning the threat to the medical profession and the public health was matched by equally articulate protests from industry, which recognized that the fantastic sums required for the so-called National Health Program would prove to be the proverbial straw upon the aching backs of tax-strained business.

The Inter-Society Committee issued a special bulletin to all members of the four national societies on April 6 in regard to the Bill.

* * *

Anent the Vincent Bill introduced in the New York Legislature to prohibit the practice of radiology by laymen, the *New York Medical Week* published the following editorial comment in its issue of March 11:

"Those branches of medicine which employ non-medical technicians are most susceptible to lay encroachment. This is notably true in radiology, physical therapy, and clinical pathology. Lay technicians, dazzled by their ability to carry out certain routine procedures, forget they are not qualified to relate their findings to the human body. Laboratories operated by laymen attempt to diagnose, and in some cases treat, disease in violation of the letter and spirit of the Medical Practice Act.

"A bill sponsored by Assemblyman Vincent makes a direct and effective attack on the practice of radiology by unqualified persons. It requires radiological laboratories to obtain a municipal permit to operate and limits the issuance of such permits to physicians, dentists, and osteopaths. To prevent terminological controversies, it defines radiology as the diagnosis or treatment of disease by exposure to radium or roentgen rays.

"The Vincent Act leaves no loopholes for quacks who like to practice with a semblance of legality. By explicitly defining radiology and limiting its practice to physicians, dentists, and osteopaths, it effectively bars this important specialty to laymen with a degree of technical skill but insufficient knowledge of medical science to practice independently."

* * *

Arthur W. Erskine, M.D., President of the Iowa State Medical Society, arranged for radiological representatives to be present at a meeting on April 11, when the Iowa Hospital Association drew up plans for a state-wide group hospitalization plan. The plan was formally approved and adopted at a meeting

on April 24. Benefits are confined to hospital accommodations; radiology, anesthesia, and pathology are excluded.

* * *

At the annual meeting of the American Medical Association in San Francisco the House of Delegates directed the Council on Medical Education and Hospitals, together with the Bureau of Medical Economics, to draw up certain standards governing the practice of radiology, pathology, and anesthesia, as well as other medical services, in hospitals. Subsequently a special committee of the American College of Radiology, in collaboration with the Inter-Society Committee, began the preparation of a "Manual of Desirable Standards for Hospital Radiological Departments." Vincent W. Archer, M.D., is chairman of the College committee.

Tentatively completed, the *Manual* was submitted to the Council on Medical Education and Hospitals by the joint Committee at a meeting between the Inter-Society Committee and the Council during the St. Louis session. When finally agreed upon, the Committee hopes to have the official approval of the Council for the *Manual*. It will be printed to serve as a reference work for hospital administrators, radiologists, and others.

In discussing the *Manual* the joint Committee raised the question of the "Essentials for a Registered Hospital," used by the Council in approving hospitals. Section 7 of the "Essentials" now reads as follows:

"7. Radiology.—The hospital should provide or have ready access to radiological equipment and service. When a full time or part time physician-roentgenologist cannot be employed, the services of such a consultant should be secured. Radiologic interpretations must be made only by a competent roentgenologist. A de-

scription of the roentgenologic examinations should be placed in the patient's chart. The physician-roentgenologist preferably should be one who is a diplomate of the American Board of Radiology or a physician whose qualifications are acceptable to the Council on Medical Education and Hospitals of the American Medical Association."

At the request of the Committee, the Council has revised Section 7, subject to approval by the House of Delegates, as follows:

"7. Radiology.—*The responsibility for all radiologic examinations must rest on the physician-roentgenologist who is head of the department.* His findings and conclusions for all examinations should be placed in the patient's chart. Nothing in this provision should preclude additional study and interpretations by qualified attending physicians on the staff.

"The physician-roentgenologist should be preferably one who is a diplomate of the American Board of Radiology or a physician whose qualifications are acceptable to the Council on Medical Education and Hospitals of the American Medical Association.

"It shall not be the policy of the hospital to make a profit from the department of radiology."

* * *

In refusing to review a decision of the California Supreme Court against the Pacific Health Corporation, the United States Supreme Court has again reaffirmed the doctrine that a corporation may not practise medicine. In rendering its decision the California Supreme Court ruled that the law forbidding the corporate practice of medicine applied to eleemosynary institutions as well as commercial enterprises. It was held that a corporation may not circumvent the law by hiring licensed physicians to render the actual medical service. By its action the Supreme Court of the United States leaves little room for debate about the legality of a corporation employing physicians to practise medicine.

MAC F. CAHAL
Executive Secretary

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

Editor's Note.—Will secretaries of societies please co-operate with the Editor by supplying him with information for this section? Please send such information to Leon J. Menville, M.D., 1201 Maison Blanche Bldg., New Orleans, La.

CALIFORNIA

California Medical Association, Section on Radiology.—*Chairman*, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles; *Secretary*, Carl D. Benninghoven, M.D., 95 S. El Camino Real, San Mateo.

Los Angeles County Medical Association, Radiological Section.—*President*, E. N. Liljedahl, M.D., 1322 North Vermont Ave., Los Angeles; *Vice-president*, M. L. Pindell, M.D., 678 South Ferris Ave.; *Secretary*, Wilbur Bailey, M.D., 2007 Wilshire Blvd.; *Treasurer*, Henry Snure, M.D., 1414 South Hope Street. Meets every second Wednesday of each month at County Society Building.

Pacific Roentgen Club.—*Chairman*, Lyell C. Kinney, M.D., San Diego; *Secretary*, L. Henry Garland, M.D., 450 Sutter Street, San Francisco. Executive Committee meets quarterly; Club meets annually during annual session of the California Medical Association.

San Francisco Radiological Society.—*Secretary*, L. H. Garland, M.D., 450 Sutter Street. Meets monthly on first Monday at 7:45 P.M., alternately at Toland Hall and Lane Hall.

COLORADO

Denver Radiological Club.—*President*, F. B. Stephenson, 452 Metropolitan Bldg.; *Vice-president*, K. D. A. Allen, M.D., 452 Metropolitan Bldg.; *Secretary*, E. A. Schmidt, M.D., 4200 E. Ninth Ave.; *Treasurer*, H. P. Brandenburg, M.D., 155 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—*Chairman*, Ralph T. Ogden, M.D., 179 Allyn St., Hartford; *Secretary-Treasurer*, Max Clinman, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida Radiological Society.—*President*, H. O. Brown, M.D., 404 First National Bank Bldg., Tampa; *Vice-president*, H. B. McEuen, M.D., 126 W. Adams St., Jacksonville; *Secretary-Treasurer*, J. H. Lucinian, M.D., 168 S. E. 1st St., Miami.

GEORGIA

Georgia Radiological Society.—*President*, James J. Clark, M.D., Doctors Bldg., Atlanta; *Vice-president*, L. P. Holmes, M.D., University Hospital, Augusta; *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Prather Clinic, Americus. Meetings twice annually, in November and at the annual meeting of the Medical Association of Georgia in the spring.

ILLINOIS

Chicago Roentgen Society.—*President*, David S. Beilin, M.D., 411 Garfield Ave.; *Vice-president*, Chester J. Challenger, M.D., 3117 Logan Blvd.; *Secretary-Treasurer*, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—*President*, Cesare Gianturco, M.D., 602 W. University Ave., Urbana; *Vice-president*, Fred H. Decker, M.D., 802 Peoria Life Bldg., Peoria; *Secretary-Treasurer*, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—The last meeting was May 2, 3, 4, 1939, held in Rockford. The officers of the Section for the meeting were Harry B. Magee, M.D., of Peoria, *Chairman*, and Warren W. Furey, M.D., 6844 Oglesby Ave., Chicago, *Secretary*.

INDIANA

Indiana Roentgen Society.—*President*, Stanley Clark, M.D., 108 N. Main St., South Bend; *President-elect*, Juan Rodriguez, M.D., 2903 Fairfield Ave., Fort Wayne; *Vice-president*, A. C. Holley, M.D., Attica; *Secretary-Treasurer*, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—*Chairman*, Whitmer B. Firor, M.D., 1100 N. Charles St.; *Secretary*, Walter L. Kilby, M.D., 101 W. Read St. Meetings third Tuesday of each month.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—*President*, Sam W. Donaldson, M.D., 326 N. Ingalls St., Ann Arbor; *Vice-president*, Clarence Hufford, M.D., 421 Michi-

gan Ave., Toledo, Ohio; *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave.

Michigan Association of Roentgenologists.—*President*, C. K. Hasley, M.D., 1429 David Whitney Bldg., Detroit; *Vice-president*, M. R. Cooley, M.D., Mercy Hospital, Jackson; *Secretary-Treasurer*, C. S. Davenport, M.D., 609 Carey St., Lansing. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—*President*, Leo G. Rigler, M.D., University Hospital, Minneapolis; *Vice-president*, Harry M. Weber, M.D., Mayo Clinic, Rochester; *Secretary*, John P. Medelman, M.D., 572 Lowry Medical Arts Bldg., St. Paul. These officers will assume their duties after the Summer meeting which will be held in connection with the Minnesota State Medical Society, May 31 to June 2, 1939.

MISSOURI

The Kansas City Radiological Society.—*President*, L. G. Allen, M.D., 907 N. 7th St., Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—*President*, Paul C. Schnoebelen, M.D.; *Secretary*, W. K. Mueller, M.D., University Club Bldg. Meets on fourth Wednesday of October, January, March, and May, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—*President*, T. T. Harris, M.D., Clarkson Memorial Hospital, Omaha; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—*President*, Milton Friedman, M.D., 31 Lincoln Park, Newark; *Vice-president*, P. S. Avery, M.D., 546 Central Ave., Bound Brook; *Secretary*, W. James Marquis, M.D., 198 Clinton Ave., Newark; *Treasurer*, James Boyes, M.D., 744 Watchung Ave., Plainfield. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Associated Radiologists of New York, Inc.—*President*, Henry A. Barrett, M.D., 140 East 54th St., New

York City; *President-elect*, I. J. Landsman, M.D., 910 Grand Concourse, New York City; *Vice-president*, Frederic E. Elliott, M.D., 122 76th St., Brooklyn; *Treasurer*, Solomon Fineman, M.D., 133 East 58th St., New York City; *Secretary*, William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

Brooklyn Roentgen Ray Society.—*President*, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—*President*, Walter Matlick, M.D., 101 High St.; *Vice-president*, Chester Moses, M.D., 333 Linwood Ave.; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen-ray Society.—*President*, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in January, May, and October as called by Executive Committee.

Long Island Radiological Society.—*President*, Samuel G. Schenck, M.D., Brooklyn; *Vice-president*, G. Henry Koiransky, M.D., Long Island City; *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn; *Treasurer*, Louis Goldfarb, M.D., 608 Ocean Ave., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—*President*, Raymond W. Lewis, M.D., 321 E. 42nd St., New York City; *Vice-president*, Henry K. Taylor, M.D., 667 Madison Ave., New York City; *Secretary*, Roy D. Duckworth, M.D., 170 Maple Ave., White Plains; *Treasurer*, Eric J. Ryan, M.D., St. Luke's Hospital, New York City; *Member of Executive Committee*, E. Forrest Merrill, M.D., 30 W. 59th St., New York City. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—*Chairman*, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

NORTH CAROLINA

Radiological Society of North Carolina.—*President*, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast

Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—*President*, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Vice-president*, R. V. May, M.D., St. Luke's Hospital, Cleveland; *Secretary-Treasurer*, Harry Hauser, M.D., City Hospital, Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President*, B. M. Warne, M.D., Doctors Building, Cincinnati; *Secretary-Treasurer*, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—*President*, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh; *First Vice-president*, Thomas L. Smyth, M.D., 111 N. 8th St., Allentown; *Second Vice-president*, Reuben G. Alley, M.D., Western Pennsylvania Hospital, Pittsburgh; *Secretary-Treasurer*, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect*, Louis A. Milkman, M.D., 212 Medical Arts Bldg., Scranton; *Editor*, William E. Reiley, M.D., Clearfield. Annual meeting, June 2 and 3, 1939, Bedford Springs Hotel, Bedford, Penna.

Philadelphia Roentgen Ray Society.—*President*, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president*, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary*, Barton H. Young, M.D., Temple University Hospital; *Treasurer*, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—*President*, William B. Ray, M.D., 320 E. North Avenue, N. S. Pittsburgh; *Secretary*, Harold W. Jacox, M.D., 4800 Friendship Ave. Meetings held second Wednesday of each month at 4:30 P.M., from October to June at various hospitals designated by program committee.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—*President*, Percy D. Hay, Jr., M.D., McLeod Infirmary, Florence; *Secretary-Treasurer*, Hillyer Rudisill, Jr., M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—*President*, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Vice-president*, Steve W. Coley, M.D., Methodist Hospital, Memphis; *Secretary-Treasurer*, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—*President*, Jerome H. Smith, M.D., San Antonio; *President-elect*, C. F. Crain, M.D., Corpus Christi; *First Vice-president*, M. H. Glover, M.D., Wichita Falls; *Second Vice-president*, G. D. Carlson, M.D., Dallas; *Secretary-Treasurer*, Henry C. Harrell, M.D., 517 Pine St., Texarkana. Meets annually. Temple is place of next meeting.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—*President*, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president*, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary*, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—*President*, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary*, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

WISCONSIN

Milwaukee Roentgen Ray Society.—*President*, H. W. Hefke, M.D.; *Vice-president*, Frederick C. Christensen, M.D.; *Secretary-Treasurer*, Irving I. Cowan, M.D., Mount Sinai Hospital, Milwaukee. Meets monthly on first Friday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—*Secretary*, Russel F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—*Secretary*, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

SUPERVOLTAGE

Shortly after the present high voltage, *i.e.*, 200 kv. apparatus, was standardized some twenty years ago, the German school developed the "massive dose" technic. In this group Wintz, Friedrich, Dessauer, and others pioneered. The method employed large fields and prolonged exposures on the theory that cancer cells should be killed rapidly and that the normal cells in the direct beam of this intensive radiation would suffer less. It appears, however, that a few years' trial of this heroic measure revealed that much radiation sickness and untoward sequelæ developed, with little apparent gain in clinical results over more moderate methods, and the practice fell into disrepute.

In America, Pfahler was the first to introduce effective sustained radiation by his "saturation" method. This was soon copied by several of us and effected a compromise between the German single massive and the French fractional methods. Due to the great distances separating the pioneers in the United States and to the lack of ready contacts among them, they developed their own individualized technics, which, strange to relate, produced approximately similar results.

Regaud, Bèclère, and Coutard were foremost among the French in the use of fractional dosage and multiple small fields and seemed to accomplish almost, if not quite, as much for the patient without the physical discomforts attending the German system.

Somewhat more recently, Chaoul, of Paris, claims to have obtained definitely superior results with his 60 kv. contact, non-filtered, fractionated procedure in superficial malignancies, and particularly in epithelioma of the mouth and cervix, and adenocarcinoma of the rectum.

One must not neglect to mention the ingenious x-ray achievement of the German Bucky with his Grenz or borderline tube excited by 10 kv. This has proved valuable in

superficial lesions, both benign and malignant, but must be employed with particular care because it can be productive of damaging sequelæ despite extremely low penetrating powers. It must be borne in mind that Bucky rays are x-rays after all, irrespective of the fact that they are not far below the ultra-violet beam on the wave length scale.

As early as 1901, during the infancy of radiation therapy, we, on the West Coast, achieved some surprisingly favorable responses in both primary and secondary cancer cases, with static machine x-ray generators, despite our meager knowledge of radiation effects and dosage factors. Then came the era of spark-coil development, followed by dry and oil-insulated transformers which heralded the period of electro-physical standards, and the rapid advancement of knowledge that stabilized radiation therapy upon its present high professional plane. Many of the heroes in the early experimental period of x-ray development paid the supreme sacrifice of their lives in order that those who followed might carry on the work for the sake of humanity, protected from all the dangers which surround both their patients and themselves.

Allow us now to review briefly the immediate past and hazard some comments on the future prospects of radiation therapy. Early in January of the present year, in conversation with one of America's outstanding radiologists in New York City, the question of supervoltage radiation came up for serious consideration. This colleague was speaking in terms of multimillion volt possibilities, while we stoutly defended the present one-half million volt accomplishment as sufficient for present-day requirements. Finally, we compromised on one million volts as adequate for a suggested five-year period of experimental clinical research. That from 500 to 600 kv. apparatus has vantage points over 200 kv. is no longer debatable, but whether the available 1,000 kv.

apparatus is superior to the 600 kv. we cannot yet be so sure. This statement is based upon a comparison between the results obtained with our own Tumor Institute's 600 kv. plant and those of the 1,000 kv. installation at the California Institute of Technology under the direction of Dr. R. A. Millikan, Dr. C. C. Lauritsen, and Dr. Seeley Mudd.

Our 600 kv. generator emits effective radiation from the tube at 550 kv., while the equipment at Pasadena has been run at from 500 kv. to 1,200 kv. effective. Both institutions use the Lauritsen open-tube method, and, strangely enough, the graph of the depth dose curve for both tubes flattens out at approximately the same level, despite their differences of potential.

From physical deductions, it does not appear that the 400 kv. apparatus can rightfully be classed in the "supervoltage" category, as gamma x-rays at this voltage are not in preponderance.

Regarding the appellation "supervoltage," this term has not been favorably received in various centers. Perhaps it would be better after all to discontinue reference to Grenz rays, soft and hard rays, surface and deep rays, long and short waves, etc., and, instead, when reporting on x-ray therapy, to state exactly the effective voltage employed. By effective voltage we do not mean the peak potential of the high voltage generator; rather, the voltage corresponding to the effective wave length of the emitted radiation. This would do away with much confusion and misunderstanding and go a long way toward standardizing our literature on radiation therapy.

ALBERT SOILAND, M.D.

ANNOUNCEMENTS

THE AMERICAN SOCIETY OF X-RAY TECHNICIANS

The American Society of X-ray Technicians will hold its fourteenth Annual Meeting at the McAlpin Hotel, New York City, June 27 to 30, inclusive.

Many interesting and instructive contributions will be presented at this meeting, on technical subjects, affording the x-ray technicians an unusual opportunity to acquaint themselves with the most modern methods employed in x-ray technic.

ANNOUNCEMENT

In the forthcoming numbers of *RADIOLOGY* there will appear a group of articles contributed in honor of I. Seth Hirsch, M.D. It was the desire of his pupils, associates, colleagues, and co-workers so to mark the thirty-fifth anniversary of his activity in radiology. The valuable contributions which the following issues will contain will constitute a milestone measuring radiological progress.

We are grateful to the Editor of *RADIOLOGY* for joining in this deserved tribute to one whose services to radiology and loyalty to the Journal have been so outstanding.

CURRIER McEWEN, M.D., Dean, New York University College of Medicine;

CHARLES GOTTLIEB, M.D., Assistant Professor of Radiology, New York University College of Medicine;

RICHARD A. RENDICH, M.D., Director, Division of Radiology, Department of Hospitals, New York City;

MILLS STURTEVANT, M.D., Professor of Clinical Medicine, New York University College of Medicine;

HENRY K. TAYLOR, M.D., Director, Department of Radiology, Welfare Hospital;

MAXWELL H. POPPEL, M.D., Roentgenologist, King's County Hospital, *Chairman.*

The Committee

IN MEMORIAM

HENRY SCHMITZ, M.D. (1871-1939)

The death of Dr. Henry Schmitz brought to an untimely end the career of a pioneer in radiation therapy. His counsel in this particular field of medicine will be greatly missed by all of us. Everyone whose privilege it was to have known Dr. Schmitz will mourn his passing.

Dr. Schmitz was born in Kaiserswert, Germany, Dec. 26, 1871, the son of John Mathias and Gertrude (Pollender). He came to this country early in life, and on Nov. 17, 1897, was united in marriage with Meta Elizabeth Lenzen, of Chicago.

Dr. Schmitz was graduated from the Loyola University Medical School, in Chicago, Illinois, in 1897, and was connected with his alma mater ever since. At the time of his death, he was Professor of Gynecology and Head of the Department. Active in organized



The late HENRY SCHMITZ, M.D.

medicine, he was a member of many associations, both in gynecology and radiology. In the treatment of carcinoma, especially carcinoma of the uterus, Dr. Schmitz played a very important rôle, and is probably best known to radiologists for his contributions on this subject. Through his untiring efforts, the Institute of Radiation Therapy was founded in Chicago in 1933, in the development of which Institute he spent much time and effort. He was a prolific writer. His articles displayed his frankness, painstaking precision, and contained many original ideas. He was the author of a number of important text-books such as: "Manual of Gynecology," the English translation of Kroenig and Friedrich's "Physics and Biology of Radiation Therapy," and many others. It would be impossible to enumerate here all of Dr. Schmitz' activities and innumerable contributions in the field of medical science.

Dr. Schmitz was past president of the American Radium Society, and also an active member of the Radiological Society of North America. During the first American Congress of Radiology, Dr. Schmitz acted as treasurer of the organization and his counsel was of the utmost importance to the success of the Congress.

He was well known and esteemed both here and abroad, and had a great many friends in radiology. He was a man who typified the best qualities of the German, and by close association his unusual traits became evident. The better acquainted one became with Dr. Schmitz, the more one appreciated his strength of character. His fairness is exemplified by his attitude toward candidates for examination, especially on the American Board of Radiology. While on the surface he may have appeared brusque, in later discussions of the candidates, his fairness to and his interest in them became evident.

Medicine, particularly radiology, has lost a great physician. We join with Mrs. Schmitz and his three sons who survive him in this, their time of great bereavement, and extend to them our deepest sympathy.

EDWARD L. JENKINSON, M.D.

BYRON H. JACKSON, M.D.

The Editor has received the sad news of the passing of Byron H. Jackson, M.D., an honored member and past president of the Radiological Society of North America.

A memorial sketch and portrait of Dr. Jackson are being prepared for a forthcoming issue of RADIOLOGY.

BOOKS RECEIVED

Books received are acknowledged under this heading, and such notice may be regarded as an acknowledgment of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

RÖNTGENATLAS DER ERKRANKUNGEN DES HERZENS UND DER GEFASSE (Roentgen Atlas of Diseases of the Heart and Vessels). An Introduction for Physicians. By Dr. WALTER BREDNOW, Professor of Internal Medicine and Roentgenology, Chief Physician at the Medical Clinic, University of Göttingen. Second, enlarged and improved, edition, containing 161 pages, with 90 illustrations. Published by Urban & Schwarzenberg, Berlin, 1939. Price: 10.50 R.M.; 12 R.M., bound.

ELEKTRODIAGNOSTIK (Electrodiagnosis). By Dr. B. NEOUSSIKINE and Dr. D. ABRAMOWITSCH, Tel Aviv. A volume containing 242 pages, with 42 illustrations. Published by Hans Huber, Bern, Switzerland, 1939. Price: 12 francs or 7.20 R.M.

ABSTRACTS OF CURRENT LITERATURE

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S. M. ATKINS, M.D., of Waterbury, Conn.	JOHN M. MILES, M.D., of Lafayette, La.
S. RICHARD BEATTY, M.D., of Denver, Colo.	R. R. NEWELL, M.D., of San Francisco, Calif.
M. L. CONNELLY, M.D., of Chicago, Ill.	LESTER W. PAUL, M.D., of Madison, Wis.
BENJAMIN COPELMAN, M.D., of Perth Amboy, N. J.	HAROLD O. PETERSON, M.D., of Minneapolis, Minn.
PERCY J. DELANO, M.D., of Chicago, Ill.	ERNST A. POHLE, M.D., Ph.D., of Madison, Wis.
SYDNEY J. HAWLEY, M.D., of Danville, Penna.	SIMON POLLACK, M.D., of Chicago, Ill.
LEWIS G. JACOBS, M.D., of Winona, Minn.	C. W. REAVIS, M.D., of Detroit, Mich.
MAX MASS, M.D., of Chicago, Ill.	ERNST A. SCHMIDT, M.D., of Denver, Colo.
JOHN G. MENVILLE, M.D., of New Orleans, La.	

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ANEURYSM

An Instructive Case of Aneurysm of the Heart Wall with "Teeter-movement" Symptom. L. Bischoff. *Schweiz. med. Wchnschr.*, 68, 1415, 1416, Dec. 31, 1938.

The author reviews the literature on cardiac aneurysm as a result of cardiac infarction. He reports a case with typical electrocardiographic signs of anterior wall infarct, which repeatedly showed clinically a pulsation of the outer chest wall in the left third inter-space, somewhat within the mammary line. This pulsation moved synchronously but paradoxically with the heart impulse. On account of tachycardia, it had a tic-tac rhythm with a slightly prolonged inward phase. The author coins the name "*gigamphisymptom*" (teeter-movement symptom) for this sign, and believes it to be pathognomonic of a left wall cardiac aneurysm. In his case, roentgen confirmation of the diagnosis was obtained.

LEWIS G. JACOBS, M.D

Clinical Aspects of Aneurysm. John H. Mills and Bayard T. Horton. *Arch. Int. Med.*, 62, 949-962, December, 1938.

A statistical study of the 596 cases of aneurysm which were observed at the Mayo Clinic during the ten-year period from 1925 to 1935 is presented. These cases are classified anatomically into intracranial, intrathoracic, intra-abdominal, those of the extremities, and miscellaneous. In other than those of the thoracic aorta, in which it ascends to 70 per cent, syphilis is negligible as an etiologic agent.

Roentgen examination is of benefit as a diagnostic aid in aneurysms of the intracranial group, particularly if calcification is present. However, this may be easily mistaken for that which may occur in a calcified cyst or tumor. Erosion of the bony processes in the area of the aneurysm may be noted. If rupture occurs, there may be ventricular displacement.

The authors discuss statistically the location, etiology, and in the intracranial and intrathoracic groups, the symptoms and diagnosis of these aneurysms. A total of 172, or 28.9 per cent, were verified at operation or autopsy.

C. W. REAVIS, M.D.

APPARATUS

Stratigraphy of the Lungs and Bones. Delaborde. *Bull. et mém. Soc. de radiol. méd. de France*, 26, 503-506, July, 1938.

Several cases are presented, demonstrating the additional information to be obtained from stratigraphy. The apparatus manufactured by the Compagnie Generale de Radiologie, marketed under the name "Stratix," is described in considerable detail. This is an apparatus in which the tube and film carrier are coupled with a lever which allows vertical movement, in opposite directions, of the tube and film. Adjustments for height, distance of tube from film, selection

of the plane desired for stratigraphy, and automatic timing are built-in. A fluorescent screen permits accurate centering and selection of the plane to be radiographed. A movable anti-diffusion grid is included. The tube may be uncoupled for ordinary radiography. The "Stratix" is an apparatus combining simplicity and accuracy.

S. R. BEATTY, M.D.

Modern High Milliamperage and High Voltage Apparatus for Roentgen Deep Therapy. W. Fehr. *Strahlentherapie*, 64, 341, 1939.

The author describes briefly a 200 kv. deep therapy apparatus which permits a tube current up to 30 ma. using a water-cooled Metalix tube. The power plant uses a Villard circuit. Another unit making use of the cascade circuit of Greinacher can be operated at 1,000 kv. and 1 ma. Illustrations of the units are shown.

ERNST A. POHLE, M.D., Ph.D.

Two Radiographic Teaching Models. W. E. Boyd. *British Jour. Radiol.*, 11, 444-451, July, 1938.

Two models are described, one a flat board in which are inserted rows of thumb tacks in a vertical and horizontal direction; the other a block made up of 10 layers of plywood, each 14 inches square and one inch thick. In each layer a row of thumb tacks were placed, so that when the layers were bolted together the rows in different layers were at different distances from the center. These models are very useful for demonstrating distortion and enlargement, and also the effect of angulation of the beam with reference to the film.

S. J. HAWLEY, M.D.

The Standing and Prospects of Miniature Photographs from the Roentgen Screen. H. Holfelder and F. Berner. *München. med. Wchnschr.*, 85, 1818-1823, Nov. 25, 1938.

The authors review the history of miniature roentgenography. With their apparatus (Siemens-Reiniger, with a Zeiss Ikon camera), they can make from 300 to 350 chest examinations an hour, in serial surveys. The resulting films are satisfactory for diagnosis, showing the lesion in all cases. Enlargements may be made, but are found to be not so sharp as good roentgenograms. The authors used the method for detecting disease, and in positive cases made the final diagnosis on the basis of standard roentgenograms. They use 24 sq. mm. for the miniature films.

From an eugenic standpoint, it is desirable to keep the amount of irradiation down. Using a piece of film in a box, out of the line of direct exposure, directly beneath the fluoroscopic screen, it was found that, after 1,200 exposures, development produced only the least fog, while a similar test at fluoroscopy showed complete blackening of the film.

For practical evaluation, 10,732 films were taken; of these, 134 were discarded because they could not

be used for diagnosis. The usual procedure of varying the lighting intensity and distance of viewing, which applies to full size films, was not found practical with miniatures. After a little practice, the authors feel that up to 500 films an hour can be examined. The correct diagnosis can be made from the miniature in all cases.

Of the 10,598 films studied, 93.1 per cent were normal, 4.5 per cent had pulmonary calcifications, 0.8 per cent had recent and not definitely healed tuberculosis, 0.07 per cent had tuberculosis with cavity, 0.05 per cent had various cardiac abnormalities, and 0.09 per cent had other abnormalities. No case of bronchiectasis was diagnosed in the series, as its signs were not definite on the miniatures.

The authors think that improvement of apparatus is needed, especially in the direction of short exposure condenser units for generating the rays. After some discussion of roentgen cinematography, the difficulties of the method are indicated, such as the necessity for perfect focusing of the camera, which, in turn, requires an unusually stable arrangement of the apparatus. The cost of the apparatus partly offsets the cheapness of the films. Regular roentgenography still remains the method of choice for study of single cases of disease, and miniatures are useful only in serial surveys. While the method has been developed for the lungs, it is naturally possible to use it in similar fashion for other organs.

LEWIS G. JACOBS, M.D.

Presentation of the Biotome of Bocage and of the Planigraph of Ziedses des Plantes. J. Massiot. *Bull. et mém. Soc. de radiol. méd. de France*, **26**, 520-523, July, 1938.

The author briefly describes the apparatus of Ziedses des Plantes for planigraphy, utilizing circular or epicycloidal movement of the tube and film, and that of Bocage, which employs only the circular movement.

The apparatus of Ziedses des Plantes is adapted to radiography of the subject in the horizontal position and is, therefore, not of use when fluid levels exist. The biotome of Bocage requires that the subject be upright. The other advantages and disadvantages of each apparatus are mentioned.

S. R. BEATTY, M.D.

Internal Targets in the Cyclotron. Robert R. Wilson and Martin D. Kamen. *Phys. Rev.*, **54**, 1031-1036, Dec. 15, 1938.

Radio-phosphorus is promising in therapy and radio-iron valuable in physiological research. They are made by bombarding ordinary phosphorus, atomic weight 31 and iron of atomic weight 58 (rare isotopes), with high speed deuterons. Working at about eight million electron volts, the Berkeley cyclotron requires a day to produce enough radio-phosphorus for use in therapy. Their best concentration of radio-iron was one microcurie per 30 milligrams iron (two weeks' bombardment). By putting a target of iron phosphide

on a "probe" into the interior of the cyclotron these yields could be increased several times, and without diminishing the beam of deuterons in the target chamber (being used for physical research) by more than 10 per cent. They produced iron of 0.5 microcurie activity per milligram by using pure iron on the probe.

R. R. NEWELL, M.D.

Practical Pulmonary Stratigraphy. C. Gaillard. *Jour. de med. de Lyon*, **19**, 643-647, Nov. 5, 1938.

Pulmonary stratigraphy is, in the opinion of the author, a valuable diagnostic method furnishing information unobtainable with ordinary methods of radiography.

It is possible to obtain excellent stratigraphs by modifying standard apparatus. The author describes his apparatus in some detail and presents examples of the films secured. Several directions of motion of the tube and film are possible. The diagrams alone will suggest the basic adaptations necessary. Such an apparatus should be inexpensive to construct and simple and accurate in operation.

S. R. BEATTY, M.D.

The Distribution of the Dose in Near-distance X-ray Tubes and Body Cavity Tubes of Various Constructions. T. Zimmer. *Strahlentherapie*, **64**, 348, 1939.

The author describes several models of the near-distance x-ray tube operating at 60 kv. and used according to the method developed by Chaoul. A series of depth dose and isodose charts are shown, as well as illustrations of two different models. One tube is especially designed for the treatment of small body cavities at 60 kv. and 2 ma. It delivers 330 r/min. at 1 cm. focus chamber distance.

ERNST A. POHLE, M.D., Ph.D.

ASBESTOSIS

Asbestosis. J. V. Sparkes. *British Jour. Radiol.*, **11**, 371-377, June, 1938.

Pulmonary asbestosis gives a different clinical, pathologic, and radiologic picture to most other forms of pneumoconiosis, because of the different nature of particles inhaled. Asbestos consists of long silky fibers, as silicate of iron and magnesium without free silica. The shape of the particles causes them to be stopped in the terminal bronchioles where a deposit of iron-containing material forms over them. These are called "asbestos bodies." They are readily demonstrated in the sputum.

The symptoms—dyspnea, cough, anorexia, lassitude, chest pain, and weight loss—are more pronounced than physical signs or roentgen-ray findings.

The roentgen-ray appearances, which are typical only when the lesion is advanced, are restriction of diaphragmatic movement; hazing of diaphragm; clouding of costophrenic angles, which may extend along the cos-

tal margin toward the apices. The heart outline is poorly defined, and there is occasional prominence of the pulmonary artery. The lung-fields show a relative increase in density in basal portions due to lack of aeration, described as "ground-glass appearances." There is a patchy increase in density throughout the lungs, but no nodulation.

The chief complications of asbestosis are: (1) recurrent bronchitis; (2) bronchopneumonia; (3) tuberculosis, and (4) carcinoma.

S. J. HAWLEY, M.D.

ASTHMA

Roentgen Studies of the Pathological Physiology of Bronchial Asthma. Leo G. Rigler and Rudolph Koucky. *Am. Jour. Roentgenol. and Rad. Ther.*, 39, 353-362, March, 1938.

Bronchographic and pathologic studies give rise to a concept of bronchial asthma and the asthmatic attacks as follows: the disease affects primarily the bronchial mucosa, producing an enormous hypersecretion of mucus which accumulates within the lumina of the bronchi. Due possibly to stasis from spasm of the bronchial muscle to marked viscosity, or to other factors, this mucus forms a plug or core, partially obstructing the bronchus so that air may be inspired past the occlusion, but is expelled much less readily. Emphysema is thus produced. During the asthmatic attack the spastic muscle clamps down around the plug, aggravating the occlusion.

Roentgen observation on living cases of bronchial asthma, by means of bronchography, demonstrates clearly the presence of these occlusive plugs during life and indicates that they are an integral part of the disease process in bronchial asthma.

Bronchography is of great value in elucidating the nature and extent of the process in individual cases and in giving some determination of the prognosis.

S. M. ATKINS, M.D.

BACKACHE

Lumbosacral Anomalies as a Cause of Low Backache. Wright Clarkson and Allen Barker. *South. Med. Jour.*, 31, 515-520, May, 1938.

Developmental anomalies of the lumbosacral spine may be a cause of low back pain by creating an unstable joint, placing undue strain on ligaments, joints, and muscles.

More significant and frequent are those cases with a narrowed lumbosacral joint and a resulting subluxation of the lumbosacral articular facets. Herniation of the nucleus pulposus into the spinal canal, with pressure on nerve roots, may be responsible for low back and sciatic pain as well as for the narrowed disk, but the pain may be due to increased tension upon the capsular ligaments or impingement of the ends of the articular processes upon the pedicles above and the lamina below. The thinning of the disk may be due to senile degeneration

or repeated trauma. Vague abdominal complaints, such as atypical gall-bladder pain, may be the result of vertebral defects.

Anteroposterior and lateral roentgenograms are made with the central ray in the anteroposterior view passing vertically between the fifth lumbar and first sacral segment.

JOHN M. MILES, M.D.

Low Back Pain in Relation to Urology. Stanley F. Wildman. *Jour. Okla. St. Med. Assn.*, 31, 35-38, February, 1938.

It is the author's contention that 75 per cent of backache in men is due to genito-urinary pathology and 50 per cent in women is gynecologic. Branches of the same nerves that supply the sacro-iliac joints go to the prostate, seminal vesicles, and rectum. Pain due to pelvic pathology may be referred to the sacro-iliac joints.

So-called sacro-iliac sprain is often due to a prostatovesicularitis and many people draw compensation for sprain when their trouble is of genito-urinary origin.

JOHN M. MILES, M.D.

Intractable Low Back and Sciatic Pain Due to Protruded Intervertebral Discs: Diagnosis and Treatment. J. Grafton Love. *Minnesota Med.*, 21, 832-839, December, 1938.

The author stresses the fact that ordinary roentgenography fails, in the vast majority of cases, to give a clue to the real pathologic condition which underlies the patient's disability in certain cases of low back pain. To-day, laminectomy for the removal of protruded intervertebral discs is one of the commonest neurosurgical operations performed at the Mayo Clinic. The anatomy of the discs is reviewed in this article. They occur throughout the spinal column from the space between the second and third cervical vertebrae to the coccyx. Those in the sacrum and coccyx are rudimentary and are rarely protruded. Certain areas are vulnerable, the lumbar particularly so.

True protrusions are most often the result of strain. Many of the patients with protrusions have anomalies of the spine such as sacralization, fusion failure, and facet anomalies. About 25 per cent of the patients are unable to recall any injury. The majority of protrusions occur laterally (the central part of the posterior longitudinal ligament is strongest and there are deficiencies laterally) and thus the unilaterality of symptoms is explained.

The tissue contains both nuclear and annular material and hence the term "protruded disc" is preferred to "herniated nucleus pulposus" and "rupture of the intervertebral disc." The symptoms, which vary with the location and the degree of protrusion, are reviewed.

Laboratory tests include examination of the spinal fluid for protein content, which is elevated, usually above 40 mg. per 100 c.c. Subarachnoid block on

puncture is rare; when it exists, paralysis is usually present also. If lesions are caudal the reversed Queckenstedt test is positive.

Roentgenography begins with fluoroscopy, after subarachnoid injection of 5 c.c. of lipiodol. It should never be used in presence of suspected inflammatory lesions; never at temperatures above that of the body; never if it is cloudy, and usually through the second or third lumbar interspace. Introduction at the level of the protruded disc may be painful.

The filling defect is usually anterolateral. Sometimes the enlarged shadow of the edematous nerve root is detected. Recently, defects due to hypertrophy of the ligamentum flavum have been recognized. Sometimes the ligamentum flavum is alone at fault. The treatment is surgical.

PERCY J. DELANO, M.D.

THE BLADDER

Dermoid Cyst of the Bladder. A. Lidzki. *Ann. Surg.*, 109, 274-276, February, 1939.

A paravesical dermoid cyst in a female, 30 years of age, which opened into the bladder, is reported in this article. Roentgenologic examination showed two shadows in the pelvis which proved to be a stone and a hair ball, lodged in the diverticulum. The cyst became practically obliterated when the fistulous tract was dilated and its contents removed.

JOHN G. MENVILLE, M.D.

The Radiological Diagnosis of Bladder Tumors. Wacław Sitkowski. *Polski Przegl. Radiol.*, 13, 153, 1938.

The author employs a double-contrast method in the diagnosis of bladder tumors. First a barium sulphate solution is injected, and later, after evacuation of the barium solution, air is insufflated. The formula for the barium solution is given as: barium sulphate, 20 grams; gelatin, 2.5 grams, and distilled water, 100 grams.

The roentgenograms obtained by this method present the details of the bladder outlines in good contrast.

ERNST A. SCHMIDT, M.D.

The Avoidance of Injurious Effects on the Bladder in Radiation Therapy of Carcinoma of the Uterus. T. C. Neff and F. Hoff. *Strahlentherapie*, 64, 113, 1939.

The adequate treatment of advanced carcinoma of the uterus requires the application of high doses which reach the upper limit of tolerance of both the rectum and the bladder. A computation of the total dose effective in the bladder wall, including both x-ray treatment and intra-uterine radium application, gave as mean value 7,000 r. This is administered during a period of approximately four weeks, following the authors' method. Numerous cystoscopic studies have established this value as the tolerance dose for the

bladder mucosa. There are, however, some patients who, with this dose, develop edema, granulations, small ulcers, and telangiectasis in the bladder wall. No serious permanent injuries have been observed, if the total dose was carefully kept within that range.

The authors also describe a method of cystoscopic color photography. They succeeded in obtaining photographs with exposure times of from one-tenth to one-twentieth of a second. The accompanying illustrations (in color) are excellent.

ERNST A. POHLE, M.D., Ph.D.

Roentgenologic Diagnosis of Placenta Previa: Indirect Placentography. Walter H. Ude, J. A. Urner, and O. F. Robbins. *Am. Jour. Roentgenol. and Rad. Ther.*, 40, 37-43, July, 1938.

An increase of more than one centimeter in the space between the presenting part and the bladder, in the third trimester, especially in the last two months, is strong evidence of placenta previa. Fecal or gas distention, which normally may increase the width of this space, is eliminated by low colonic flushes.

The central type practically always displaces the presenting part upward over the entire upper surface of the bladder, while the partial type usually depresses one of the lateral horns of the bladder and displaces the presenting part somewhat toward the opposite side.

Technic.—The urinary bladder is catheterized and from 25 to 40 c.c. of a contrast solution is instilled. After withdrawal of the catheter, a compression band for stabilization of the abdomen is applied and an anteroposterior view of the abdomen in the prone position is made. A lateral and oblique view may be taken in addition.

Of the last 44 cases of abnormal bleeding in the third trimester examined, 39 were diagnosed negative, four placenta previa of the central type, and one of the partial. Clinically, 40 were negative, three central placenta previa, and one partial. The roentgen examination alone is not sufficient but must be combined with the clinical. Blood clots in the lower uterine segment, though rare, may simulate the roentgen findings of this condition.

S. M. ATKINS, M.D.

BRONCHIECTASIS

The Rôle of Inflammatory Bronchial Stenosis in the Etiology of Bronchiectasis. Paul H. Holinger. *Ann. Otol., Rhinol., and Laryngol.*, 47, 1070-1082, December, 1938.

Obstruction of a bronchus is now recognized as the chief cause of acquired atelectasis. Anspach has previously reported a series of 50 cases, taken from a group of 100, in which a triangular shadow had been observed at the base of one or both lungs for periods up to 12 years. Such shadows and findings frequently led to a diagnosis of pneumonia, unresolved pneumonia, mediastinal or interlobar empyema, or atelectasis. Anspach correlated the triangular shadow with atelec-

tasis and demonstrated by serial x-rays and post-mortem studies that bronchiectasis developed in the atelectatic areas if they remained atelectatic. During the past two and one-half years, a majority of these cases have been studied again and additional information has been gained regarding the intrabronchial pathology. Inflammatory bronchial stenosis was found to be responsible for the production of the original pulmonary lesion, atelectasis. The author uses the term "prebronchiectasis" to describe the condition at this stage, before definite bronchiectasis has developed. At this time the lesion is characterized, clinically, by an area of dullness, bronchial breathing, râles, a chronic cough, and a low-grade elevation of temperature which may have followed an upper respiratory infection or a so-called pneumonia. Persistence of such findings is of utmost significance, since x-ray examination reveals evidence of atelectasis.

The bronchoscopic picture is that of an acutely inflamed bronchial orifice, stenotic, from which pus oozes without bubbling. By shrinking the mucous membrane around the stenosed orifice with cocaine, or by dilating it with forceps and then passing an aspirator directly into the orifice, pus can be released and normal function can eventually be restored. Subsequent lipiodol instillation reveals a normal bronchial tree. If untreated, this type of case eventually develops bronchiectasis. In cases of atelectasis of longer duration an attempt should be made bronchoscopically to open the airway and permit better drainage of pus, although there may be no hope of restoring normal function. In some cases in which atelectasis had been present for more than a year, there were definite bronchiectatic cavities with marked lung destruction.

LESTER W. PAUL, M.D.

Bilateral Lobectomy for Bronchiectasis. Dudley E. Ross. *Canadian Med. Assn. Jour.*, 39, 549-552, December, 1938.

Unilateral lobectomy for bronchiectasis has now become a common operation. The mortality rate reported by various authors is approximately 10 per cent. Bilateral lobectomies, on the other hand, have been infrequent, only nine being reported, with one death. The author reports in detail two additional successful cases.

The author believes the most important single factor affecting the death rate in bilateral lobectomy is the stage of the disease at which the operation is carried out. Archibald divides the condition into three stages, the first being purely bronchitic with no bronchographic changes; the second stage showing cylindrical and sacular dilatation, cough, and copious muco-purulent sputum, which on culture yields no anaerobes, and the third or fetid stage characterized by quantities of foul-smelling sputum containing anaerobes. Bronchograms reveal large bronchiectatic cavities.

The general use of bronchograms has facilitated the recognition of bronchiectasis before it has progressed to the fetid stage. Operation at this early period has lessened considerably the chances of a fatal empyema.

M. L. CONNELLY, M.D.

THE BRONCHI

Bronchostenosis: A Roentgenological Study. Nils Westermark. *Acta Radiol.*, 19, 285-312, September, 1938, and 313-336, October, 1938.

The author discusses the occurrence and course of bronchostenosis in different diseases of the lung and stresses the importance of bronchostenosis and its complications in radiological diagnosis.

Radiologically, bronchostenosis may be divided into three stages: Stage 1 with mild atelectasis and hyperemia as prevalent manifestations; Stage 2 with local emphysema and anemia, and Stage 3 with massive pulmonary collapse (obstructive atelectasis). These reported changes take place in the lung area corresponding to the stenosed or obstructed bronchus. A transitory stage occurs between Stages 1 and 2; this period is characterized by inspiratory atelectasis and expiratory emphysema.

Dependent on different stages and different phases of respiration, both the size and shape of the affected area may show marked changes in the roentgenogram. The outlines of the typical radiopaque wedge may become concave or convex; in advanced cases the affected areas may assume spherical shapes.

Bronchostenosis may be due to a large variety of causes which can be generally reduced to (1) changes in the lumen of the bronchus, (2) changes in the bronchial wall, and (3) changes outside the bronchus.

The article is well worth reading in the original.

ERNST A. SCHMIDT, M.D.

The Anatomy of the Bronchial Tree and its Clinical Application. J. Hardie Neil, W. Gilmour, F. J. Gwynne, Wallace Main, and W. A. Fairclough. *Australian and New Zealand Jour. Surg.*, 8, 118-131, October, 1938.

Although the secondary branching of the main bronchi is well known, few workers have studied the tertiary branches, considering the latter too inconstant for classification. The authors carried out a detailed study of the bronchial tree of various animals and numerous cadavers in which the material used included both metal casts of the bronchial tree and dissections of these structures, in specially fixed lungs. They found each third-order bronchiole to be the air supply for definite segments of lung tissue, which they mapped out. These anatomical units were designated as bronchopulmonary segments and were found to be constant in almost 100 per cent of the cases studied. Although their classification of these segments follows closely that of Kramer and Glass, they add one of their own discovery (subapical). They found that this division into such segments corresponds to the primary budding of the 9 mm. embryo's bronchi. The classification is as follows:

Upper Lobe: (1) apical (the segment usually involved in tuberculous infections); (2) anterior; (3) axillary; (4) paravertebral.

Middle Lobe: (5) anterior; (6) axillary.

Lower Lobe: (7) apical; (8) paravertebral; (9) posterolateral; (10) anterolateral; (11) mesial or cardiac; (12) subapical.

Confirmation of these findings was obtained by roentgenographic study of the chests of human subjects after 1 c.c. of lipiodol had been instilled into various of the above-designated third-order bronchi.

The clinical importance of this study is reflected in the localization of lung abscesses, foreign bodies, and bronchiectatic involvements. These segments appear to be the units of lung tissue, involved in these and other pathologic processes.

The authors also describe a procedure of broncho-clysis indicated in the treatment of bronchiectasis whereby merthiolate or metaphen, in 1:10,000 dilution in a saline isotonic solution, is introduced by catheter into the bronchiole of the involved segment of the lung. Increasing amounts of this solution from two progressing up to six ounces are introduced by a Murphy drip, at a rate of 30 drops a minute. The solution is absorbed by the peribronchial lymphatics and has a marked beneficial effect in sterilizing the bronchiectatic cavities and clearing up the perifocal areas of pneumonia.

SIMON POLLACK, M.D.

CALCULI

Differential Diagnosis of Biliary and Urinary Calculi. Henri Pons. Bull. et mém. Soc. de radiol. méd. de France, 26, 421, 422, June, 1938.

By placing the patient on the table in the prone position and making two exposures on the same film, shifting the tube from left to right in the interval, it is possible to differentiate between biliary and urinary calculi by comparing the shift of the image of the calculus with that of the vertebral bodies. If the apparent shift is less than that of the vertebral bodies, the calculus is posterior to these bodies, and, consequently, in the urinary tract. If the shift is greater, the calculus is anterior and, therefore, in the biliary tract.

S. R. BEATTY, M.D.

Formation of Transparent Gas-filled Fissures in Gallstones, and Their Significance for the Radiological Diagnosis. Åke Åkerlund. Acta Radiol., 19, 215-229, September, 1938.

Contrary to the common opinion that fissure formation is observed only in dried specimens of gallstones, the author points out that gallstones frequently exhibit this phenomenon *in vivo*. Usually these fissures are filled with fluid or semifluid material and do not provide any marked radiographic contrast to the body tissues. However, the fissures assume radiological significance in the rather rare cases in which they show unusual radiotranslucency or are able to alter the specific gravity of the concrement, which latter

feature becomes apparent in roentgenological sedimentation examinations. In these instances, both the increased transparency and the low specific gravity of the calculi were due to the presence of gaseous substances in the fissures. For this gas-production, either gas-forming bacteria or other disintegration processes may be responsible. The specific gravity of the fresh specimens was estimated to range between 1.010 and 1.035, and lies, therefore, below the specific gravity of pure cholesterol. The fissures are, as a rule, star-shaped and may, in certain cases, facilitate the diagnosis of biliary calculi.

Note: In this connection, the abstractor wishes to point out the similarity between this phenomenon and the presence of gas in emphysematous cholecystitis in cases in which the gas formation is apparently due to the same causes. (For details, see his article on "Emphysematous Cholecystitis and Pericholecystitis." RADIOLOGY, 31, 423-427, October, 1938.)

ERNST A. SCHMIDT, M.D.

CANCER (DIAGNOSIS)

The "Romantic" Attributes of "Lawlessness" and "Malignancy" in Cancer. Horst Oertel. Am. Jour. Med. Sci., 197, 1-7, January, 1939.

The so-called "lawlessness" and the malignant aggressive behavior of cancer are considered in this article.

The views that cancer cells are lawless, wild-growing, contrary to rules, and, hence, gangsters of the body, must renounce all intelligibility of cancer growth. It is a logical principle of all scientific inquiry that, in Nature, nothing occurs without a lawful causal chain, whether it fits into the normal causal scheme, or whether it lies outside of it. In the case of cancer, observations exist which point to a consistent and definite plan in the manner of growth.

In the gastro-intestinal tract, one may see the simple substitution of normal glandular epithelium by cancer cells which follow the normal architecture. Such simple substitution, an indication of intensity or tempo of growth, occurs in non-cancerous types as well. (It is only when these cells begin to reproduce that they break with the normal arrangement.)

The subsequent structural environment into which the cancerous tissue moves has a decided influence on its subsequent manner (differentiation) and intensity of growth; hence it is quite impossible to grade malignancy according to the type of cell occurring in a particular locality.

Metastases also show a normal sequence of structural development, except for the initial stage.

All these features of cancer growth may be reduced to the basic fact of intensity of growth.

The tumor cells, by virtue of their primary vascular or lymphatic position, have the first call on the nutritive material, permitting them to expand and encroach upon the wasting parenchyma. The so-called infiltrative (malignant) capacity is in reality only an intra-

canalicular vascular advance. Nowhere is there specific, direct aggression on parenchyma. Malignancy is, therefore, also reducible in terms of tempo of growth.

In order to arrive at a better understanding of cancer, the "romantic" ideas must be abandoned, and the subject treated as a problem of growth.

BENJAMIN COPLEMAN, M.D.

Primary Carcinoma of the Bronchus. Ira H. Lockwood. *South. Med. Jour.*, 32, 30-34, January, 1939.

Primary bronchial carcinoma comprises from 6 to 8 per cent of all carcinomas, and ranks next to malignancies of the gastro-intestinal tract in frequency.

It is characterized by a great variation in symptoms, which depend upon the location and size of the tumor, adjacent structures, and secondary changes. In 15 per cent of all cases, the primary tumor produces no signs or symptoms.

Any intrathoracic inflammatory condition which is unusually persistent should make one consider malignancy. An irritating, non-productive cough, a wheeze most marked at the end of expiration, and blood-streaked sputum are important symptoms.

Pain, dull or severe, constant or intermittent, may be the first symptom, and the author reports three cases in which the initial symptom is a low back pain.

JOHN M. MILES, M.D.

Early Diagnosis of Cancer of the Stomach. Louis J. Notkin. *Canadian Med. Assn. Jour.*, 40, 8-13, January, 1939.

Four cases of carcinoma of the stomach are reviewed, in which the x-ray diagnosis was made too late to be of service. Progressive changes in the films are demonstrated. The author believes radiologists should recognize early lesions as seen in the first examination or in repeat examinations done within reasonable periods. Diagnostic roentgen methods and criteria are very briefly discussed.

M. L. CONNELLY, M.D.

Carcinoma and Venous Thrombosis: The Frequency of Association of Carcinoma in the Body or Tail of the Pancreas with Multiple Venous Thrombosis. E. E. Sproul. *Am. Jour. Cancer*, 34, 566-585, December, 1938.

The incidence of thrombosis in any portion of the circulatory system and the associated conditions were noted in a series of 4,258 consecutive necropsies. Carcinoma was found to be the most common cause of thrombosis of the neck, abdomen, pelvic veins, and extremities. Of 16 cases of carcinoma of body or tail of the pancreas, 56.2 per cent showed thrombosis and 31.3 per cent of these 16 cases showed widely disseminated venous thrombosis. Inflammation or invasion of these thrombosed vessels by tumor could not be demonstrated.

Carcinoma of the stomach was also associated with a high incidence of thrombus formation.

Other carcinomas were not associated with multiple thrombi, although single thrombi were reported in many cases.

The possible effect of interference with the blood-clotting mechanism by pancreatic activity is discussed. It is also suggested that achlorhydria associated with carcinoma of the stomach may alter the action of the pancreatic enzymes and thereby alter the coagulation of the blood.

The literature is thoroughly reviewed.

H. O. PETERSON, M.D.

The X-ray Diagnosis of Gastric Cancer. A. J. Delario. *Jour. Med. Soc. New Jersey*, 35, 548-551, September, 1938.

A discussion of various roentgenologic types of gastric carcinoma is presented, stressing the diagnostic and therapeutic problems. The author advocates routine annual examinations especially for patients over 40 years of age. It is a short general treatment of the subject and contains no new material.

MAX MASS, M.D.

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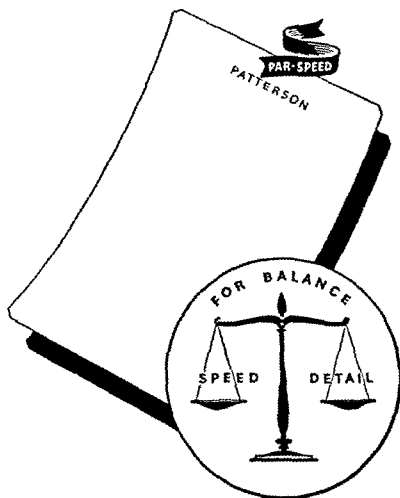
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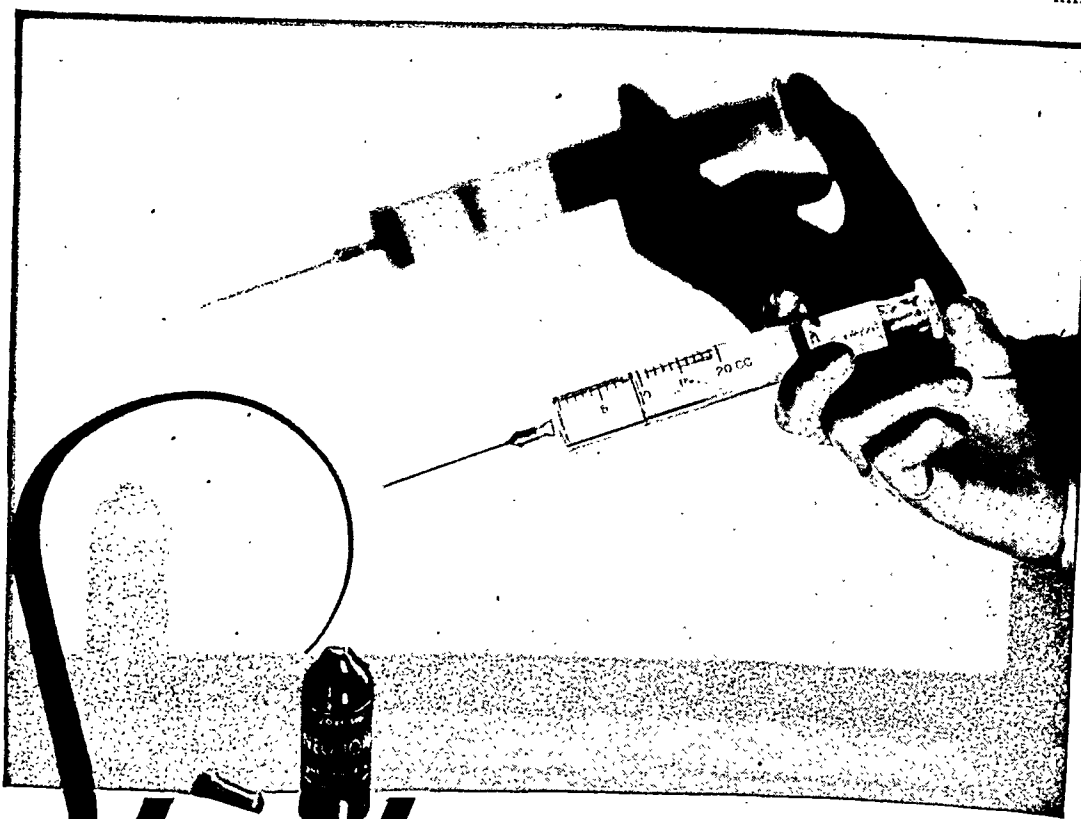
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SCHERING CORPORATION

BLOOMFIELD, N. J.

RADIOLOGY

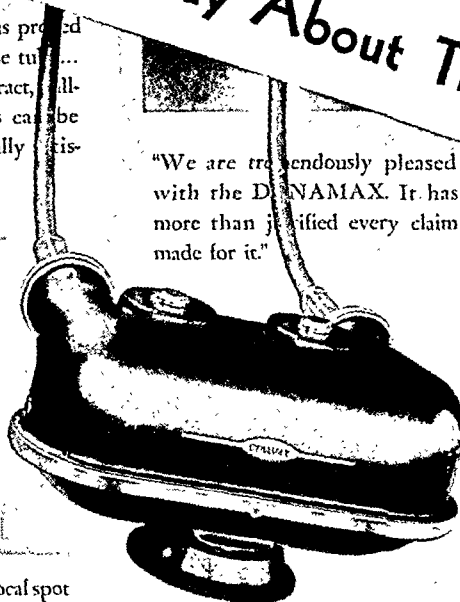
What Users Say About The DYNAMAX

"The DYNAMAX has proved to be an ideal all-purpose tube... Chest, gastro-intestinal tract, gall-bladder and extremities can be radiographed with equally satisfactory results."

"We are tremendously pleased with the DYNAMAX. It has more than justified every claim made for it."

"Since the installation of the DYNAMAX we have diverted much work formerly done in other rooms to it because of the general superiority of the DYNAMAX."

"The DYNAMAX is our first rotating-anode tube... The improvement over previous results really is amazing."



"Whether I use the 1 mm. focal spot at 200 MA or the 2 mm. spot at 500 MA I get results of a quality I never before seen."

"After rigorous use we are glad to report that the DYNAMAX is still functioning as efficiently as the day it was installed. We now regard it as indispensable."

"Involuntary motion presents a problem. The DYNAMAX completely solves it."

NO greater compliment can be paid any product than the enthusiastic endorsement of persons who have purchased it, submitted it to the test of daily use, and found no claim made in its behalf extravagant, no assertion of superiority unwarranted.

Successful because it has satisfied every quality requirement of the modern laboratory, the DYNAMAX Rotating-Anode Diagnostic Tube is a product of the con-

summate skill accumulated from long experience by an organization whose entire facilities and personnel—physicists, engineers and craftsmen—are devoted to the design and manufacture of X-Ray tubes exclusively.

Your Machlett dealer will be glad to supply you with complete information regarding the DYNAMAX. Or write directly to us for complete descriptive literature.

DEPENDABLE

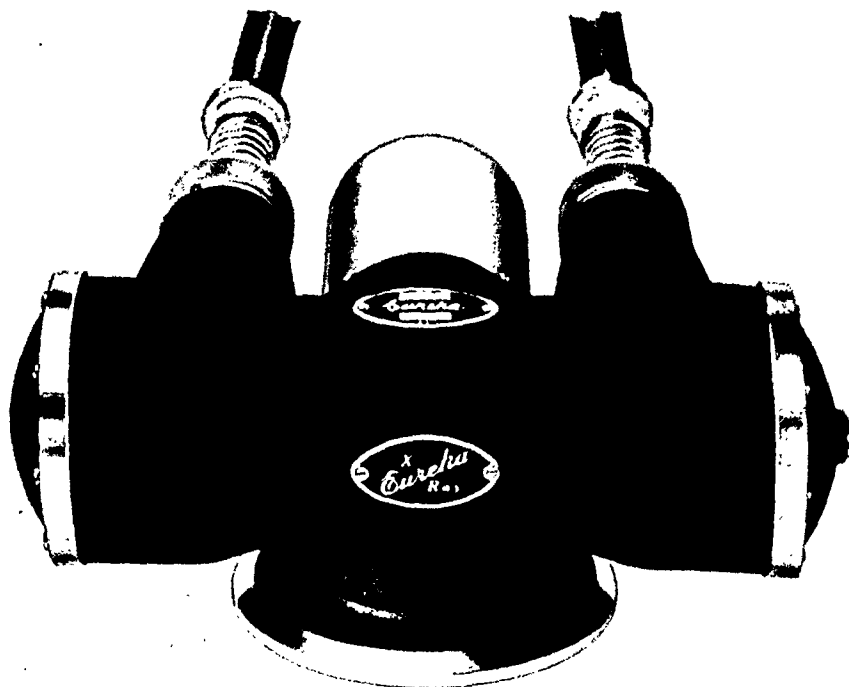
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**100 KVP ON FULL WAVE; 90 KVP ON HALF WAVE & SELF
Milliampere loads depend on the focus selected**

CABLE TERMINALS MAY BE VERTICAL, HORIZONTAL OR 45° ANGULAR

Double focus x-ray tubes have the focus switch mounted on the cathode cable terminal in plain sight for use when the unit is positioned for operation. The switch is included in the price. Two nine foot shock proof cables with aerial terminals are included with each SPI x-ray tube.

CATALOG LISTINGS

SINGLE FOCUS		DOUBLE FOCUS	
E-280	1.5 mm.	E-286	1.5 & 3.6 mm.
E-281	2.0 mm.	E-287	2.0 & 3.6 mm.
E-282	2.8 mm.	E-288	1.5 & 4.8 mm.
E-283	3.6 mm.	E-289	2.0 & 4.8 mm.
E-284	4.2 mm.	E-290	2.8 & 4.2 mm.
E-285	4.8 mm.	E-291	2.8 & 4.8 mm.

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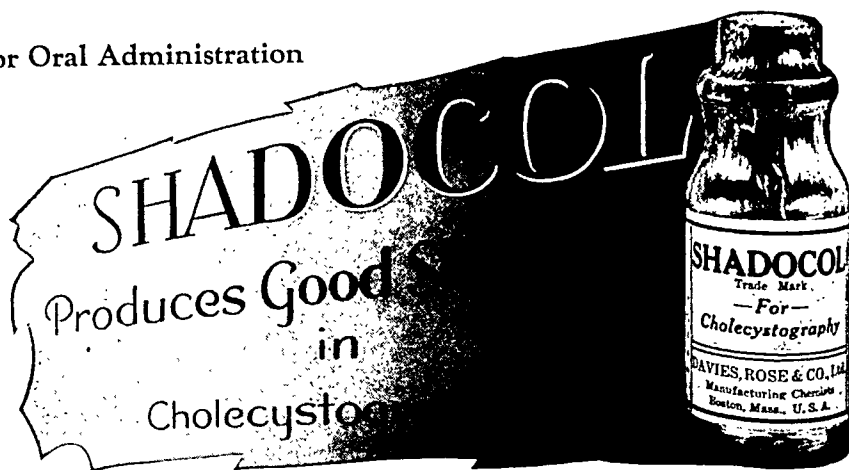
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400	8.21	12.26	17.87	20.86	28.39	32.77	37.73	41.28	11.14
500	9.47	13.94	20.02	23.27	31.91	36.68	42.05	46.00	13.07
600	10.74	15.58	22.16	25.67	35.43	40.60	46.38	50.72	13.89
700	12.01	17.28	24.31	28.08	38.95	44.52	50.70	55.44	15.82
800	13.28	18.95	26.45	30.49	42.47	48.43	55.02	60.16	17.74
900	14.55	20.62	28.60	32.98	45.99	52.35	59.34	64.88	19.67
1000	15.81	22.30	30.74	35.31	49.51	56.26	63.67	69.60	21.59
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